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INHALT

Adolf HOFFMANN, In Memoriam Halûk Abbasoğlu 5

Moritz KINZEL – Lee CLARE – Devrim SÖNMEZ, Built on Rock –
Towards a Reconstruction of the ›Neolithic‹ Topography of Göbekli Tepe 9

Erkan DÜNDAR, Late 4th Century B.C. Pottery Assemblages from Patara.
First Considerations on Ceramic Classes of the Xanthos Valley in Lycia. 47

Christoph BÖRKER, Das Taubenmosaik des Sosos aus der Villa Hadriana
und seine Stellung im späthellenistischen Kunstbetrieb Pergamons 73

Serra DURUGÖNÜL – F. Fatih GÜLŞEN, Two ›Large Herculaneum Women‹
Statues from Anazarbos. 107

Bahadir DUMAN – Esen OGUS, A Mythological Sarcophagus from Tripolis,
Asia Minor, and Its Implications for Practices of Sarcophagus Workshops. 123

Constanze HÖPKEN, Der Barbier von Doliche. Haarschneideklingen
und ein Rasiermesser aus der römischen Siedlung auf dem Keber Tepe. 157

Daniel BAUER, Die Abteilung Istanbul des Archäologischen Instituts
des Deutschen Reiches in den Jahren 1933 bis 1944 179

KURZMITTEILUNGEN

Yaser DELLAL – Mustafa Kemal ŞAHİN, The Madrasa at Kalehisar.
Preliminary Results of the Archaeological Survey 2019 209

Anschriften der Autoren / Adresses 223

Hinweise für Autoren 224

Information for Authors 225

MORITZ KINZEL – LEE CLARE – DEVRIM SÖNMEZ

Built on Rock – Towards a Reconstruction of the ›Neolithic‹ Topography of Göbekli Tepe

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Schlüsselwörter: Göbekli Tepe, Neolithikum, Fundstellengenese, Paläorelief, Landschaftsrekonstruktion

Anahtar sözcükler: Göbekli Tepe, Yakın Doğu Neolitik'i, yerleşme oluşumu, paleo-rölyef, peyzaj rekonstrüksiyonu

Introduction

Göbekli Tepe lies some 15 km east-northeast of Şanlıurfa and 2.5 km east of Örencik village in the Germuş mountain range. The site, which is situated upon a star-shaped limestone plateau, has commanding views over the Harran Plain to the south; the modern city of Şanlıurfa and the Kaşmer Mountains to the west and southwest; and the Tektek Mountains to the southeast. On days with good visibility, the eastern Taurus Mountains and Karacadağ volcanic massif are visible on the horizon to the north and east. Originally discovered during an archaeological survey in 1963[1], excavations did not begin at the site until its ›re-discovery‹ by Klaus Schmidt in 1994 (*fig. 1*)[2]. Since then, the prehistoric mound has always been described as an artificial (anthropogenic) accumulation of material (*figs. 2. 3*), including architectural remains and midden deposits, that amassed upon the flat surface of the rock plateau[3]. The tell features higher-lying mounds separated by lower-lying hollows and is reported to be 15 m high, which corresponds to

Sources of illustrations: Fig. 1 = DAI / Göbekli Tepe Project Archive (K. Schmidt 2009). – *Fig. 2* = after Kurapkat 2015, fig. 10. – *Fig. 3* = after Schmidt 2006 and Kurapkat 2015, fig. 14. – *Figs. 4–6* = DAI / Göbekli Tepe Project Archive, edited by M. Kinzel 2018. – *Fig. 7–16* = M. Kinzel. – *Fig. 17* = DAI / Göbekli Tepe Project Archive, after N. Becker 2015, edited and revised by M. Kinzel 2018. – *Fig 18* = M. Kinzel 2018. – *Fig. 19* = DAI / Göbekli Tepe Project Archive (orthophoto based on SfM-recording by D. Sönmez 2017, prepared by M. Kinzel 2018). – *Fig. 20* = DAI, Recording and Analyses, Maps GGH-Solutions in Geosciences Freiburg. – *Fig. 21* = DAI / Göbekli Tepe Project Archive 2016. – *Fig. 22* = Göbekli Tepe Project Archive (M. Kinzel 2018). – *Fig. 23* = DAI / Göbekli Tepe Project Archive, prepared by D. Sönmez 2018. – *Fig. 24* = DAI / Göbekli Tepe Project Archive (M. Kinzel 2018).

Abbrevations:

GP = *Gründungspunkt* / Foundation point

BR = Bedrock

1 Benedict 1980.

2 Schmidt 1998a / b; Schmidt 2000, and Schmidt 2006.

3 Kurapkat 2015, 11 figs. 10. 14; Schmidt 2006, 227–228; Schmidt 2009, 188–191; Schmidt 2012, 214–215.

Fig. 1.
The mound of Göbekli Tepe seen from the northeast

an elevation of 786 m above sea level, making it the second highest point in the Germuş Mountains[4].

Since 1996, a total of eight monumental structures with a round-oval ground plan, two large central T-shaped pillars (up to 5.5 m high), up to three enclosing stone walls, reflecting different building phases, T-shaped pillars incorporated into the enclosing walls (2.5–3.0 m in height) and stone ›benches‹ along the interior perimeter walls were exposed[5]. These structures have been interpreted as ritual buildings of significant importance in a wider regional context[6]. The monumental buildings at Göbekli Tepe were found filled with enormous amounts of detritus material. These deposits, commonly referred to as ›backfill‹, consisted of extensive amounts of fist-sized limestone rubble interspersed with archaeological artefacts, primarily lithics, worked stone and animal bone, as well as small amounts of fragmented human bone[7]. It has previously been argued that these buildings were intentionally buried[8] during ceremonies that included lavish feasting events[9]; however, this explanation now appears increasingly unlikely. Instead, the monumental structures were – as we will show later on – probably inundated by building collapse and eroded deposits from higher-lying parts of the mound. Notably, this new interpretation challenges the previously postulated ritual backfilling (›burial‹) scenarios[10] and therefore also the hypothesis that these were realised in the frame of feasting events[11].

The earliest Neolithic buildings at Göbekli Tepe were erected upon the limestone plateau, which also provided the essential construction material for the stone-built structures[12]. As the

4 According to R. Braun's geographical studies (pers. comm.) the highest point of the Germuş Mountains is situated northwest of Göbekli Tepe; see also Knitter et al. 2019.

5 Schmidt 2006. The monumental special buildings – previously referred to as enclosures – were labelled in the order of their discovery: Building A from 1995/96; Building B from 1997; Building C from 1998; Building D from 2001; Building E in 1995; Building F from 2006; Building G from 2006; and Building H from 2010 onwards. None of the structures has been completely exposed.

6 Schmidt 2006.

7 Gresky et al. 2017.

8 Schmidt 1998b.

9 Notroff et al. 2014.

10 Schmidt 1998b, 1; Özdoğan – Özdoğan 1998, as well as Özdoğan 2018, 18.

11 Notroff et al. 2014; Schmidt 2006; Schmidt 1998a.

12 Cf. Kurapkat 2014, 70; Kurapkat 2015, 26–27; Schmidt 2009, 207–217. Neolithic builders may have taken advantage of natural erosion processes in limestone rock formations, primarily choosing banked limestone formations

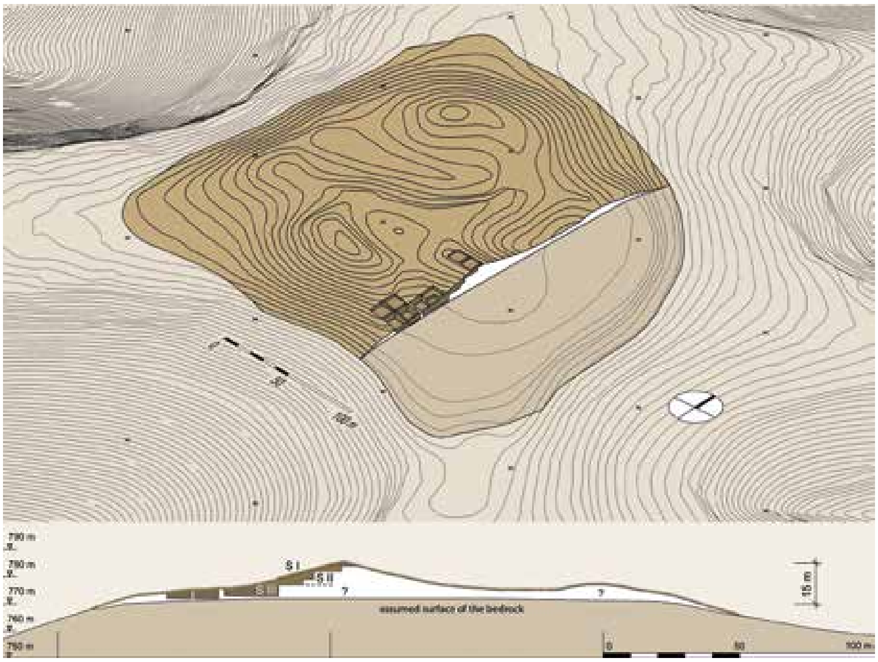
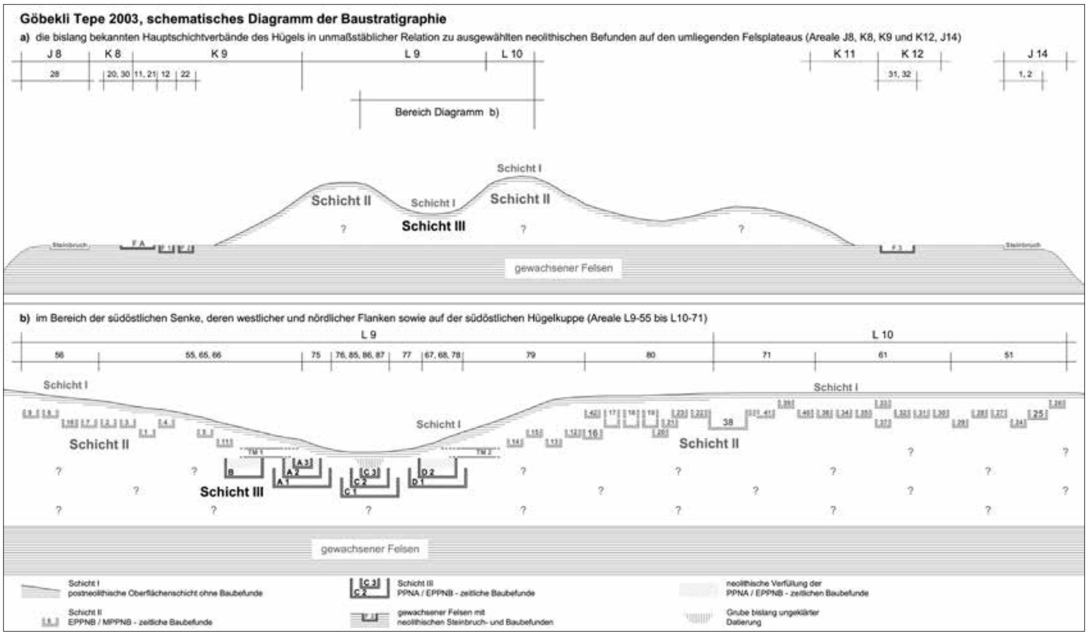


Fig. 2.
The ›tell‹ of Göbekli Tepe according to Schmidt (2012)

Fig. 3.
Stratigraphic model (2003)
▽



with natural cavities and cracks for quarrying activities. The slopes of the plateaus would have provided an excellent source for different sized stone, which occurred as natural erosion products that were essential for the construction of walls, floors and roofs. For some thoughts about Neolithic quarry activities at Göbekli Tepe, see also the studies by C. Beuger (2018).

settlement became increasingly dense, rock formations became more and more inaccessible to the Neolithic stonemasons, who were forced to relocate their efforts to acquire suitable building material to the more distant fringes of the plateau[13].

The early Neolithic buildings, whether monumental or normal in scale, appear to be built on bedrock rather than cut into deposits, and were surrounded by other buildings[14] and not by earth as presented earlier[15]. This might be especially true for the monumental structures in the southeast (main excavation) area. Nevertheless, some structures may have been placed partly into the slope[16], as known from sites like Çayönü[17], Nevali Çori[18], as well as Shkārat Msaied[19], Beidha[20] or Kharaysin[21]. In the case of the ›special buildings‹, these may have been built partially up against the step of the next highest rock outcrop.

As previously mentioned, the tell was until recently reported to consist of a 15 m high accumulation of Neolithic deposits, which was differentiated into at least two major phases of building activities. Whereas the oldest ›Layer III‹ was attributed to the Pre-Pottery Neolithic A (PPNA, ca. 9600–8700 B. C.), the youngest ›Layer II‹ was assigned to the subsequent Early Pre-Pottery Neolithic B (EPPNB, ca. 8700–8200 B. C.)[22].

However, information obtained from recent excavations at Göbekli Tepe, which included deep soundings down to the natural bedrock in preparation for the construction of the recently erected protective shelters, together with observations from previously exposed buildings, show that this hypothesis requires substantial revisions. Instead, it is now evident that the mounds[23] and hollows of the prehistoric tell follow the natural relief of the underlying rock-scape[24]. In oth-

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13 On the other hand, there is also the chance that the entire plateau was exploited throughout the occupation, in order to locate appropriately sized stone blocks. When were the large T-shaped pillars actually quarried and erected?

14 Kinzel – Clare 2020.

15 E. g. Kurapkat 2012, 162.

16 As described earlier by Kurapkat 2015, 52.

17 Schirmer 1990; Erim-Özdoğan 2011.

18 Hauptmann 1993; Hauptmann 2011.

19 Kinzel 2013, 41.

20 Byrd 2005, 74.

21 Ibáñez et al. 2015.

22 Dietrich 2011, 13–14; Kurapkat 2015, 18–23; Schmidt 2012, 213–219. It may be argued that layers I to III/IV were initially seen as a working model. However, over time, the uncritical use and reception of it has established a research opinion rarely questioned or thoroughly debated, see as well Kinzel-Clare 2020.

23 We are aware that the mounds are still not fully understood as they have not been sufficiently studied. However, there are a number of hints explained below that might give some insights into the nature of the mounds.

24 R. Herrmann has described the rocks attested at Göbekli Tepe in his report (2012) as follows: »*Nr. I (oberste Schichtstufe): olm1-8-s; dabei handelt es sich um eine Schichtstufe aus dem Oligozän-Unteren Miozän in Form von Kalksteinen als chemische Sedimentgesteine im Schelfbereich. – Nr. II (lokale Zwischenstufe): m3ßk; dabei handelt es sich um eine Schichtstufe aus dem Oberen Miozän in Form von Basalten bzw. und vulkanischen Gesteinen; örtlich als Basaltgeröllfeld im südlichen Bereich des Westplateaus vorhanden. – Nr. III (untere Schichtstufe): e3ol-7. sy; dabei handelt es sich um eine Schichtstufe aus dem Oberen Eozän-Oligozän; in Form von tonigen Kalksteinen und Sedimentgesteinen in Schelf-Hangbereichen […] Die Schicht I als Kalksteine in Form von chemischen Sedimentgesteinen stellen – bis auf Kluftstrukturen mit Kluftfüllungen aus Lösslehm einen für die Gründung und Verankerung sehr gut bis gut tragfähigen Baugrund dar. Infolge der Störungszone im Bereich des Göbekli Tepe können aufgelockerte Zonen aus Scherung und Gebirgsdruck sowie größere Trennflächen und Basaltgänge oder Spalten vorhanden sein, die stärker verwittert sind oder als sehr witterungsempfindliche Basalte (s.g. Sonnenbrenner) auftreten. Diese Zonen sind als Schwächezonen als gering tragfähig –insbesondere für Verankerungen– einzustufen*«; see as well the geological map of the Urfa region N41(MTA2014).

er words, the underlying rock formations dictated the development of the built environment (i. e. formation processes) at the site[25] and influenced the preservation of the various buildings. The processes and events that formed the site of Göbekli Tepe as we know it today were incredibly complex and often intertwined. Natural and anthropogenic processes would have gone hand in hand and often also at the same time. As segments of earlier walls were modified and integrated into later walls and buildings, stratigraphic relations became increasingly complex and blurred[26]. It follows that isolated events and structures, and their respective chronological sequences, are difficult to identify and reconstruct. Especially the ›backfill‹ excavated from within the monumental buildings, described in earlier publications as an ›intentional‹ act[27], presents a significant challenge, one which requires further studies before more reliable conclusions are possible.

Attested Rock Surfaces in the Main Excavation Area (Southeast Hollow)

Observations from recently excavated deep soundings, together with a reassessment of data from earlier excavations, suggest the presence of several different rock surfaces (terraces) within the main excavation area at Göbekli Tepe (*fig. 4*). These steps in the natural rock-scape show a clear increase in elevation from south to north, mirroring the present topography of the accumulated prehistoric mound (*table 1*).

Excavations in Building C and Building D have uncovered large portions of rock surfaces that served as floors in these structures (BR1 and BR2); these rock surfaces had been carefully levelled and smoothed in what would have been painstaking work[28]. These rock floors are characterised by a slight gradient to the south, following the natural inclination of the slope towards the valley. Considering that pillars, sculptures and wall stones were quarried and produced on the spot, it is likely that the elevation of the natural, original rock surface prior to building activities taking place, was some 40 cm higher and that the rock surface was weathered and irregular. We have to assume that the Neolithic stonemasons worked with an approximate allowance of about five to twenty centimetres when quarrying the limestone objects. This allowance also needs to be accounted for when reconstructing the original elevation of the bedrock.

The difference in elevation between the rock floors in Building C and Building D is around 2.25 m; the elevation of the floor in Building C (BR2) is approx. 769.40 m[29], whereas the smoothed rock floor in Building D (BR1) is at approx. 771.65 m. This not only points to a significant and definite step in the rock escarpment, but also that these buildings were constructed on different rock terraces on the slope (*fig. 5*).

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25 Over the years, a number of studies dealing with the sediments and soils at Göbekli Tepe have been undertaken (e. g. Pustovoytov 2002; 2006; Pustovoytov – Taubald 2003; Pustovoytov et al. 2007); however, these studies did not focus on site formation processes but instead on the identification of periods of use and abandonment.

26 The three previously differentiated layers do not exist in the simplicity postulated earlier (Schmidt 2012, 213–219), although their status as building phases may still prove valuable (cf. Kinzel et al. in prep.; Kurapkat 2015; Piesker 2014). Nevertheless, the general sequence of events, their interpretation and connected assumptions require careful (re-)consideration.

27 Sometimes referred to as the ›burial‹ of buildings (cf. Notroff et al. 2014, 85; Schmidt 1998b; Schmidt 2010b, 16–18; Özdoğan 2018, 13).

28 A detailed study of the worked rock surfaces is pending but would add considerably to the understanding of work processes and quarry activities at Göbekli Tepe.

29 All elevations are in metres above sea level (m a.s.l).

Bedrock	Sounding	Trench	Level (m a.s.l.)
BR1	Worked bedrock floor in Building D	L9-68/78	~ 771.65
BR2	Worked bedrock floor in Building C	L9-77/87/86	~ 769.40
BR3	GP1 (west of Building D)	L9-58	772.8
BR4	GP2 (northwest of Building D)	L9-69	772.26–772.38
BR5	GP3 (northeast of Building D)	L9-78	771.55–771.73
BR6	Sounding C (northwest of Building C)[32]	L9-77	769.54
BR7	Sounding D or GP4 (Building C)	L9-97	770.05
BR8	Sounding E (east of Building C)	L9-87	769.55
BR9	GP9	L9-85	769.75–770.00
BR10	GP10	L9-84	768.80
BR11	GP5	L9-74	~ 768.80
BR12	Loc. L9-75-63.1 (2010)	L9-75	769.78–769.58
BR13	GP7 (southwest of Building B)	L9-66	770.90–771.00

Table 1 Rock Surfaces at Göbekli Tepe (SE Area)

In Building A and Building B[30], the two other special buildings[31] found in the Southeast Hollow, rock surfaces have thus far not been uncovered. However, the excavations in the deep soundings (GP1 to GP10), which were undertaken in preparation for the construction of the new permanent shelter, have provided good evidence for the natural bedrock surface and the rock relief in this area. In most cases, a natural, unworked rock surface was visible (*fig. 4*).

While the rock surface (BR5) revealed in GP3, to the east of Building D, is at approximately the same elevation as the floor of this building, the rock surface exposed west of Building D is about one metre higher. The latter rock surface (BR3; Loc. L9-58-165.11) was found west of the exterior limits of the second ring wall of Building D, below a hard-packed clay surface inside a smaller round structure (Loc. L9-58-175) that had been built against the exterior wall of Building D (Loc. L9-69-145).

The rock surface (BR6) exposed northwest of the inner wall of Building C, in sounding C (after Piesker 2014), is at the same elevation as the floor visible in the central part of this building (BR2). South of Building B, in GP7, the bedrock surface (BR13) was measured at 770.90 m, which is approx. 1.20 m below the latest plaster floor in Building B.

The rock surface (BR10) exposed in trench L9-84 (GP10: 768.80 m) is about 0.60 m lower than the floor surface in Building C (BR2: 769.38 m). However, this does not explain the underlying rock formation as both areas are connected by a narrow stairway leading into the so-called ›dromos‹. The entrance to the ›dromos‹ is at an elevation of 772.40 m, which is about a metre higher than the top of the staircase. The stairs bridge a height of about 2.61 m (from 768.80 m to 771.41 m). This significant difference in height may be explained by accumulated deposits, or an underlying rock formation[33].

30 See Kinzel-Clare 2020 for further insights into the building archaeolgical results for Building B.

31 For a discussion of the term ›special building‹, cf. Kinzel 2019.

32 According to Piesker 2014, 18 soundings C, D and E were located in Building C.

33 The bedrock levels in Building C (Loc. L9-77-87) and 20 m south of it (Loc. L9-75-85) are almost at the same elevation, as shown by the reconstructed elevation model for the main excavation area. Three scenarios are possible:

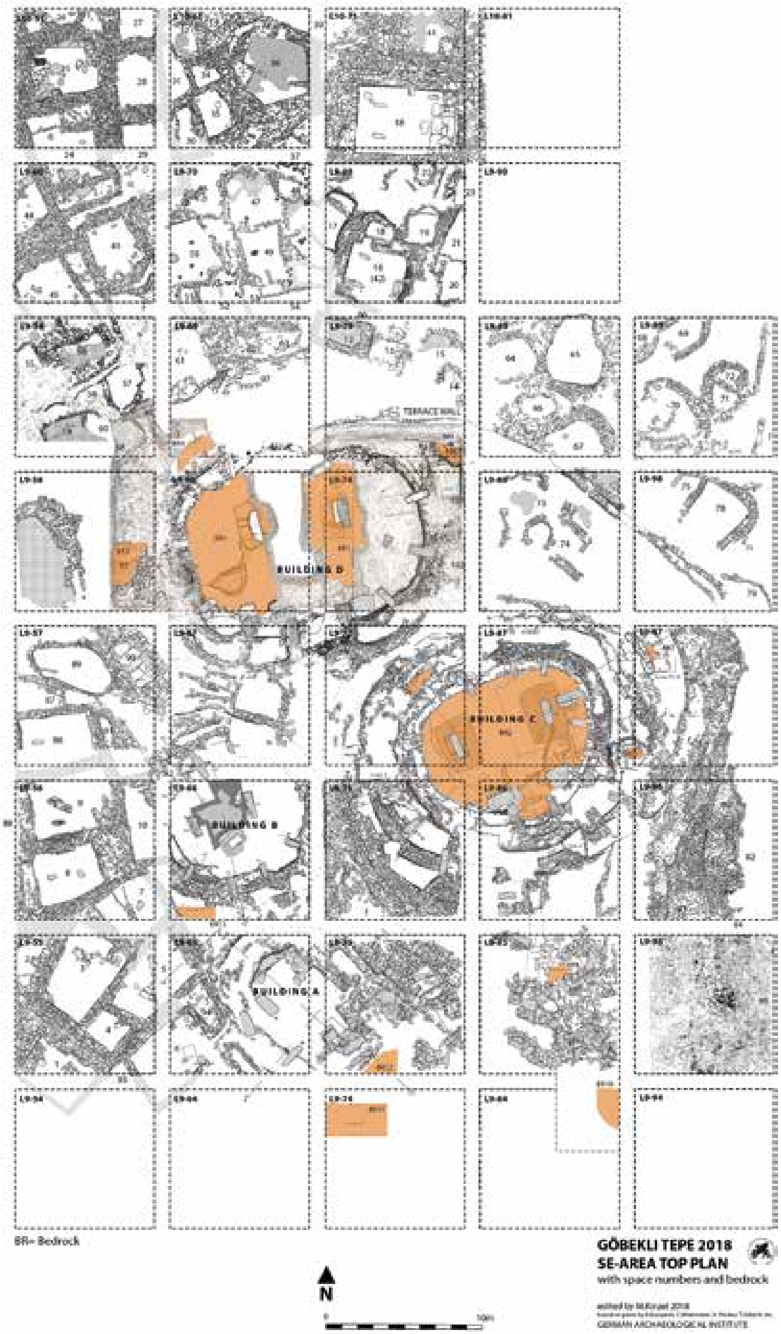

Fig. 4.
Göbekli Tepe: attested rock surfaces (orange) in the Southeast Area

A) the area where Building C was built and that south of it had the same elevation before the occupation; B) substantial efforts were made to smoothen the area of the floor in Building C, cutting down at least one metre of limestone to build Building C (e. g. by extracting some of the T-shaped pillars on the spot); or C) a rock formation south of Building C, separating the areas of (relative) similar elevations from each other; bridged by the staircase and ›dromos‹. The differences in elevation of the rock-scape may have been enhanced here by the aforementioned scenario B, where substantial amounts of limestone had been cut back in order to construct Building C.

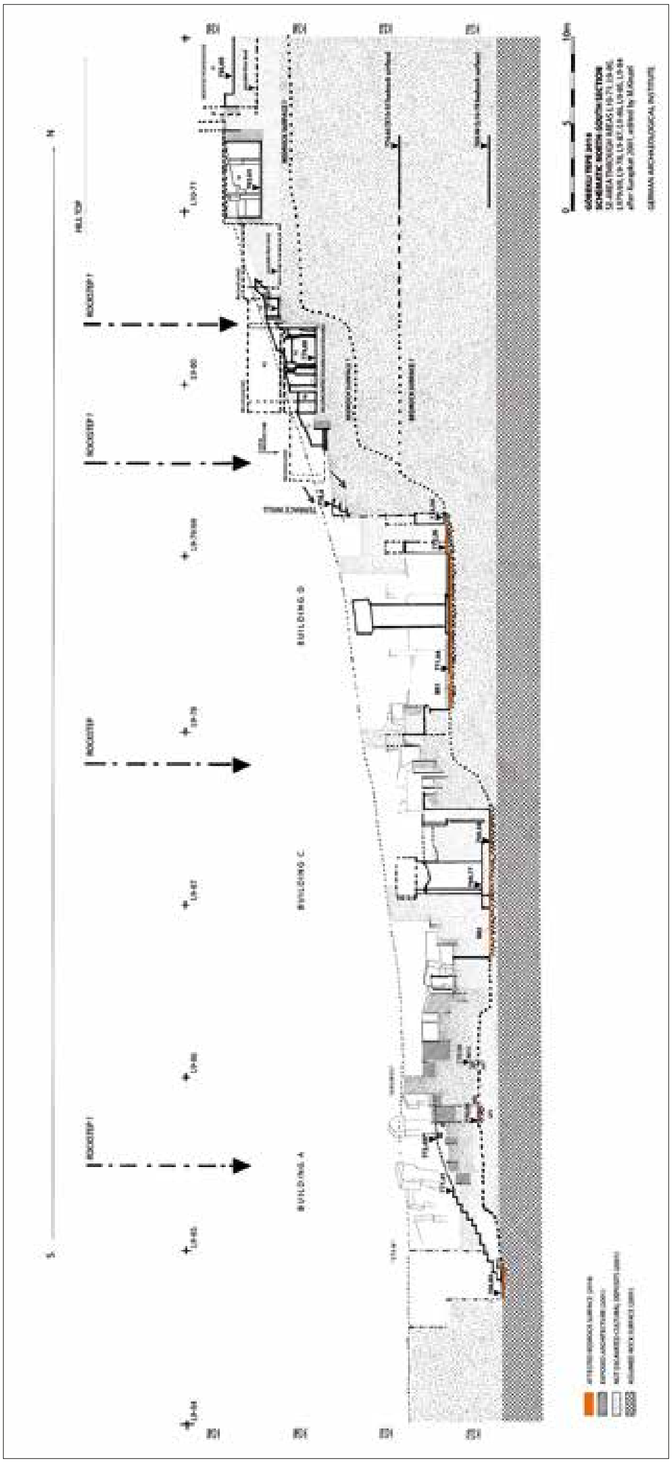

Fig. 5. N-S section through the main excavation area: reconstructed rock formation in relation to PPN buildings

A substantial wall (Loc. L9-75-72/73) found south of Building A, in trench L9-75, which runs eastward into trench L9-85, suggests a further step in the rock formation. The rock surface inside this structure (BR12; Loc. L9-75-63.1) is at an elevation of between 769.78 and 769.58 m. The rock surface (BR11) in the southerly adjacent trench L9-74 is at an elevation of 768.40 m, which is about one metre below the floor level in Building C. It is still unclear how these two rock surfaces (BR11 and BR12 in L9-74 and L9-75 respectively) are related.

In the area of the slope north of Building D there is currently no direct evidence concerning the underlying rock formation. However, there are some observations that provide suggestions as to what could lie beneath the archaeological layers:

1) A discernible cut in the architectural remains, which runs W–E from trench L9-49 to trench L9-79, may be indicative of a significant slope slide event (this will be discussed in more detail below); however, this also raises the question as to why other higher-lying structures in the northern parts of these trenches remain intact. One interpretation may be that the underlying rock formation provided enough support for the sediments and buildings, thus preventing a more severe slide of the settlement debris[34].
2) A rubble layer found in this area could be part of slope stabilisation measures, perhaps following the above mentioned slope slide event, including the construction of a terrace wall (Loc. L9-79-0020/21, L9-68-0003 and L9-67-0004/5)[35].
3) North of the exterior wall (›outer‹ or second ring wall) of Building D, an intentional fill, comprised of large stone slabs (in Loc. L9-69-141.5) covered by fist-sized stones, suggests that the builders were aware of the pressure emanating from the slope[36]. However, they underestimated the actual loads imposed on the upper parts of the wall, which were clearly the weak points

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34 The cut through the buildings has previously been interpreted as resulting from the construction process of Building D, in which the buildings were partially removed and cut to allow for the construction of Building D. This interpretation may be applicable to some of the earlier round structures, often referred to as the ›nucleus tell‹ (Becker et al. 2012, 15–16; Dietrich 2011, 13; Notroff – Dietrich 2011; Piesker 2014, 35–36; Schmidt 2011, 47–48), but not to the PPNB buildings on the slope. If the PPNB buildings on the slope were demolished in order to erect Building D, this would imply a (very) late construction date for this building. This scenario is, however, contradicted by the most recent radiocarbon dates (Kinzel – Clare 2020). On the other hand, none of the PPNA round structures found close to Building D so far are cut or disturbed by the larger building. Another explanation for the cut of the floors in the PPNB rectangular buildings north of Building D could be that the PPNB structures rest (partially) on the remains of a substantial, as yet unexcavated building, providing essential support for subsequent construction work. An additional scenario involves a combination of underlying rock formations and the building of structures. The clear north-south oriented cut through the PPNB structures in trenches K10-80/79/78 in the Northwest Area was interpreted in a similar manner, i. e. that houses were cut in order to erect a large structure, the presence of which is currently indicated by a T-pillar and a large, decorated portal stone in trenches K10-89 and K10-88. Again, if this was the case, it would imply a comparatively late date for this structure. However, the explanation for the abrupt cut of PPNB structures seems simpler: as the architectural remains are very close to the surface, it is plausible that they were removed in the course of field-clearing activities. In other words, the observed cut may be the result of ploughing. Higher-lying stone structures may have been either destroyed or considerably disturbed so that no recognisable structures have survived. On the other hand, it is also possible that the area was kept free of buildings. In this area, it appears that the PPNB buildings were constructed upon a layer of stabilised fist-size stones, which could indicate that some clearing and terracing activities had taken place.

35 The terrace wall around the Southeast Hollow has been discussed in detail by Schmidt (2010b, 17–20).

36 Unfortunately, excavations have not been conducted in the area below this fill and the exterior wall of Building D.

of the structure; this is visible in the failure of the upper parts of wall structure Loc. L9-69-145 and L9-68-795[37]. This filling was supposed to seal the gap between the exterior wall and the (possible) rock formations surrounding Building D to the north, or just meant to stabilise the surrounding (soil) deposits.

4) Significant steps in the heights between related spaces in the so-called PPNB architecture that are hard to explain by ›floor rising‹ events; e. g. in trench L9-80 where there is about two metres difference in heights between space 16 (ca. 778.4 m) and space 18 (ca. 780.4 m)[38].
5) The presence of circular structures that had obviously been modified and integrated into later PPNB rectangular buildings may indicate that archaeological layers are (at least here) not as deep as postulated earlier[39]. Otherwise, we would expect superimposition of the round by rectangular structures, and this is certainly not the case in trenches L9-80 and L10-71[40].

The findings would be considerably different had the mound built up as postulated by Schmidt and others[41]. It also would not explain why the walls situated closer to the slope are more heavily damaged than those standing in other parts of the site[42]. Typically, walls that are closer to the sediments show better states of preservation as they are better protected against (gravitational) colluvial and erosion processes[43]. Did the relatively weak exterior walls of the large buildings (here Buildings C and D) fail to withstand the pressure from the slope that eventually led to a slope slide event[44] ? This scenario seems to be the case for at least one destructive (high-energy?)

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37 Wall Loc. L9-68-795 was exposed in 2006 in Loc. L9-8-103.1 and L9-68-104.4, but was not recorded then.

38 Cf. Kinzel et al. 2020; Gebel 2006, 66; Gebel et al. 2006, 220; Kinzel 2004, 19. Kinzel (2004) presents two possible interpretation scenarios for such contexts: either parts of the building structure were intentionally filled during the PPNB occupation in order to create a new building on top of the old walls, or the filling material belonged to a second storey that had existed on top of the preserved basement. Gebel (2006, 220) defines ›Rising-floor structures‹ as follows: An architecture in which storeys »move« upwards by the vertical extension of walls and by raising the floors with room fill, often related to ›split-level‹ architecture.

39 E. g. Kurapkat 2015.

40 Kinzel et al. 2020; Kinzel – Clare 2020; Kinzel et al. in prep.

41 In 2006, K. Schmidt stated that the formation could stem from natural processes, though he still argued for a solely anthropogenic origin: »*Daß wir die Gebäude der Schicht III mit Steinmaterial, Sedimenten usw. verfüllt fanden, hätte sich ohne weiteres aus der Topographie ergeben können. Das Material hätte durch natürliche Ereignisse und Witterungseinflüsse und erosive Kräfte dort hineingelangt sein können. Doch konnten wir feststellen, daß die Verfüllung der Anlagen der Schicht III zum großen Teil anthropogenen Ursprungs ist*« (Schmidt 2006, 227).

42 Various case studies for collapse patterns are presented e. g. in Furger 2011.

43 *Colluvium* is described as follows: »An unconsolidated mass of rock debris and weathered material that has accumulated at the base of a cliff or slope and deposited by surface wash and various mass movement processes« (Goudie 2014, 17), or according to Goudie (2004, 173) »Sedimentary material that has been transported across and deposited on slopes as a result of mass movement processes and soil wash. It is frequently derived from the erosion of weathered bedrock (eluvium) and its deposition on low angle surfaces, and can be differentiated from material which is deposited primarily by fluvial agency (alluvium). Colluvium can be many metres thick and can infill bedrock depressions (Crozier et al. 1990). It often contains palaeosols, which represent halts in deposition, crude bedding downslope, and a large range of grain sizes and fabrics (Bertram et al. 1997)«.

44 In geomorphological terms slide events are described as »[…] a widespread form of mass movement. They take place along clear-cut shear planes and are usually ten times longer than they are wide. Two subtypes are translational slides and rotational slides. Translational slides occur along planar shear planes and include debris slides, earth slides, earth block slides, rock slides, and rock block slides […]. Rotational slides, also called lumps, occur along concave shear planes, normally under conditions of low to moderate water content, and are commonest on thick, uniform materials such as clays […]. They include rock slumps, debris slumps, and earth slumps« (Huggett 2007, 64).

event[45]. Currently, it cannot be ruled out that slope slide events occurred on several different occasions[46].

With its inclination of ca. 20°, the pressure (lateral forces) that emanated from the northern slope of the Southeast Hollow would have been enormous and would have been concentrated along the northern part of the exterior wall of Building D and the northern and the northeastern sections of the exterior wall of Building C. The weight of the buildings erected on the slope would have added to the general load of the sloping sediments[47]. Re-building and maintenance work on these structures would also have increased the load, thus pushing the slope with ever greater force towards the exterior walls of Building C and Building D. A critical tipping point may have been reached following heavy rainfall, perhaps associated with an abnormally wet winter[48]. The exterior walls of Building C and Building D, which at this time were functioning as fragile retaining walls, would no longer have been able to withstand the pressure. The collapse of these walls would have been the result[49]. Recent tests on the behaviour of dry stone retaining walls under pressure suggest that the Neolithic walls at Göbekli Tepe were not sufficient to withstand an increased slope pressure[50]. This scenario could also explain the substantial disturbances

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45 The faunal material from the so-called sediment column excavated from the fill in Building D also suggests periods with less or no activities during the infill process (J. Peters pers. comm. 2017), which could point to interim phase between slope slide events following stabilisation measures. Additionally, Pustovoytov mentions fossils that indicate hiatuses in the sedimentation process of the fill inside the larger buildings (2006, 716).

46 For further insights into the analyses and discussion on the heterogeneous nature of the fill of Building D see Pöllath et al. in prep. and Breuers – Kinzel in prep.

47 Future slope slide simulations may add valuable insights into Göbekli Tepe's site formation processes. Recent studies on landslides have shown that heavy rain can trigger substantial slide events as the penetrating rain water change the soil properties significantly (cf. Askarinejad et al. 2018; Martelloni et al. 2012). A study of the slope stability and potential failure may add significantly to our understanding of possible events and the impact such an event would have had, including a possible explanation as to how the collapsing earth and stone material would had been sorted and settled (cf. Duncan et al. 2014; Niederschick 2007; Craig 2004; Aysen 2002; French and Whitelaw 1999; Ferro-Vázquez et al. 2017).

48 Extreme weather conditions, including heavy rain- / snowfall, could be related to the so-called ›Levantine Moist Period‹ (Clare 2016, 24–28; Weninger et al. 2009).

49 In his report on the geological context of Göbekli Tepe, undertaken in order to define the location of the foundations for the new shelter, R. Herrmann (2012, 4–5) refers to the challenging properties of the abundant soils: »*Die anstehenden Böden bestehen somit aus der Vielzahl an Steinen, aus der früheren Nutzung oder den aus den Kalksteinen gebildeten durch Verwitterung (chemische, mechanische Verwitterung und Erosion), gebildeten Böden. Diese Böden stellen sich nach DIN 18 196 als Schluffe, sandig, (UL -Lößböden) und windverfrachtete Böden dar.* […] *Die Charakteristik von Lössböden besteht –infolge des Ausgangsgesteines der Verwitterung: Kalkstein- in der hohen Trockenfestigkeit. Die hohe Trockenfestigkeit stellt bodenmechanisch eine hohe Kohäsion c` dar, die im ›trockenen Zustand‹ die Standsicherheit maßgeblich beeinflusst. Damit können Böschungen senkrecht geböscht werden, die damit über einem längeren temporären Zeitraum standsicher sind. Die Dauerhaftigkeit der ›scheinbaren Kohäsion‹ ist besonders bei den Anlagen A und B, die überdacht sind und für die topographisch kein Sickerwasserzulauf vorliegt, ausgewiesen. Die Trockenfestigkeit ist aber bodenmechanisch als ›scheinbare Kohäsion‹ einzustufen, die bei Wasserzutritt in Abhängigkeit von der Wasserzufuhr über die Zeit vollständig verloren geht. Weiter können sich entlang des Felshorizontes Sickerwasserhorizonte mit Sickerlinien bilden, die einen Strömungsdruck aus der Sickerwasserströmung auf die Bodenzonen bewirken. In der Gesamteinwirkung aus Verlust der ›scheinbaren Kohäsion‹ und ›Strömungsdruck‹ aus der Sickerwasserströmung kann ein Gelände- bzw. Böschungsbruch auftreten, der sich nicht ankündigt und als ›plötzliches Versagen‹ auftritt*«.

50 McCombie et al. 2012a; Mundell 2009; Mundell et al. 2009a; Mundell et al. 2009b; Mundell – McCombie 2009. The team around Mundell and McCombie investigated the behaviour of dry stone walls made of limestone, following earlier tests by Burgoyne (1853), in order to develop better tools for assessing the conditions of existing retaining walls. The combined testing of 1 : 1 wall segments and computer simulations showed that some dry stone walls are still in stable equilibrium, although showing bulging deformations (McCombie et al. 2012b, 243; Mundell 2009).

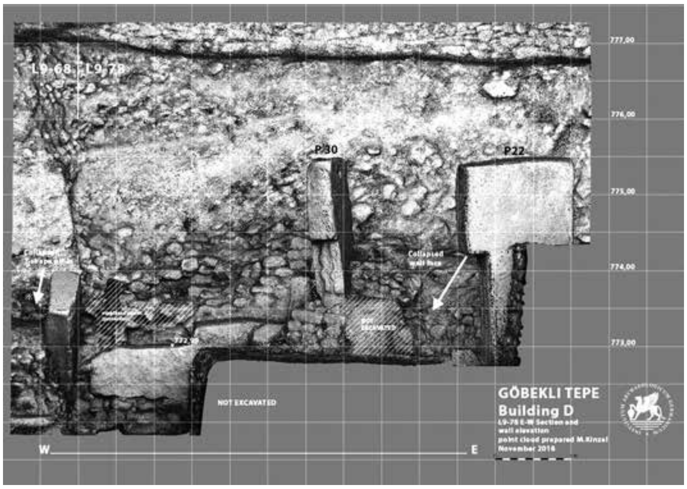

Fig. 6.
Damages in Building D: broken and re-fitted T-shaped pillar (P30) and disturbed wall Loc. L9-78–63 and wall Loc. L9-78–55

observed along the exterior (slope facing) walls of Building C and Building D, and the damages to some of the T-pillars within them (*fig. 6*)[51]. What remains unclear is in what state the buildings were in when they were hit by a slope slide: were the structures well-maintained, or were they in a state of disrepair? Especially interesting would be information concerning the roofing of the structures as this would provide insights into the reasons for why the central pillars (P18 and P31) in Building D are still standing[52].

According to the (so far unpublished) radiocarbon dates for Building D, final building activities – attested in the walls around pillars P42 and P43 – occured in the period between 8600–8370 cal. B. C.

Following such ›forceful / high-energetic‹ events, certain intentional slope protection or stabilisation measures probably took place in order to keep the place ›functioning‹. In this context, it is likely that some clearing measures followed, including, for example, the removal and translocation of displaced rubble and sediments[53]. Two different stabilisation activities have been identified in this area of the site, and include the installation of stabilised rubble-layer surfaces, consisting of mainly fist-sized stones and compact mortar material[54], and the terrace wall (Loc. L9-79-20; ca. 0.8 m high) that runs around the edge of the Southeast Hollow at an average eleva-

51 Cf. Pillars: P25, P26, P28, P30, P39, P40, P41, P44, P46, P47, P59, PMA.

52 It is outside of the scope of this contribution to discuss in detail possible roof constructions; please refer to the detailed debate by D. Kurapkat 2012 and 2015. It is clear that at the point when a critical mass of detritus material was deposited in Building D, the two central pillars must have had a support of some kind to keep them in place, though the nature of which cannot be determined at the moment. A slope slide, e. g., from the slope north of Building D, would have provided a considerable amount of material; embedding about a third of the central pillars into the accumulated material and keeping them in place while additional material was accumulating. By the influx of the detritus material the ›free-standing‹ central pillars were turned into ›embedded‹ or ›restrained‹ pillars, ensuring the preservation of their ›original‹ position.

53 Ruined houses can serve as (temporary) storage areas for building materials extracted from other ruins (Kinzel 2013, 206).

54 Broken wall stones and fist-sized stones are generally the preferred material for such measures; they are easy to collect and can be carried, e. g., in baskets, to the spot that is in need of stabilisation (Kinzel 2013, 233–234).

tion of 777.20 m. This terrace wall was constructed on a paleo-soil[55] that was dated around 8241–7795 cal. B.C. It has to be stated that the terrace wall may have seen some repairs and shows in other locations several building phases. The preserved parts of the terrace wall clearly reflect the latest state. The compact fist-sized stone material has been found behind the terrace wall (uphill), as well as downslope, extending over the infilled larger Buildings D and B (*figs. 7–16*)[56].

A further (later) terracing (Loc. L9-80-9), located just 9 m north of the first, is oriented east-west and transverses the then infilled, space 16. These stone settings are much less substantial than the earlier terrace wall (Loc. L9-79-20).

On top of the stabilised rubble surface in this area, two rooms had been built re-using parts of the former upper-storey walls (Loc. L9-80-8 and L9-80-23), which most probably represents one of the latest use-phases of the (M ?)PPNB structures at Göbekli Tepe[57]. Comparable rubble layers are known from other PPNB sites, e.g. ʻAin Ghazal, Basta and Baʼja, all of which are located in the Southern Levant[58]. Rubble stone material seems to stem initially from the stone built architecture, and was in some cases, e.g. here at Göbekli Tepe, singled out to be partially re-used for stabilisation works. Similarly, some filling processes[59] and blocking of wall openings at Göbekli Tepe (e.g. Loc. L10-71-76[60] in space 38, the so-called ›Lion-Pillar‹ Building) could be related to such a scenario, too.

The 2011 ram probes[61] taken in Building B (L9-67) did not provide any additional information about the depth of the rock surface in this area of the mound, hitting stone after just 0.35 m. This result does not come as a surprise, especially as collapsed wall material was to be expected here. However, as latest building archaeological studies have shown also Building B has a long and complex building biography and the attested plaster floor only reflects the latest phase[62].

Attested Rock Surfaces in the Northwest Area

For a better understanding of the entire site, and to show that the Southeast Hollow is not an exception, we will now consider rock surfaces attested in the Northwest Area at Göbekli Tepe (*table 2*). The findings from this part of the site demonstrate that here, too, the palaeo-relief had a direct impact on the preservation of the architecture and the site formation processes. However, due to its slightly different topographical setting, patterns are not identical with those observed in the Southeast Hollow, although buildings do seem to follow the natural setting. Data from trench K10-13/23, excavated in the run-up to the construction of the protective shelter in this area, have provided good evidence of how the natural rock escarpment was used in the construction of buildings upon it.

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55 Pustovoytov 2006.

56 This surface is not horizontal but follows the inclination of the slope.

57 Schönicke 2019; Kinzel et al. 2020.

58 Gebel 2009; Gebel et al. 2006; Kinzel 2013; Rollefson 2009; Weninger et al. 2009; Zielhofer et al. 2012.

59 Future micromorphology studies may provide further insights that will help us understand these processes better (cf. Nicosia – Stoops 2017).

60 In the possible blocking, a re-used decorated stone (Catalogue No. C6) was exposed, though it is unclear if this stone is part of the blocking or served as a sill for a smaller window-like wall opening (Kurapkat 2015, 32–33).

61 2011 excavation diary from trench L9–67.

62 Kinzel – Clare 2020.

Fig. 7.
Göbekli Tepe: Reconstruction scenario – SE area before the Neolithic occupation

Fig. 8.
Göbekli Tepe: Reconstruction scenario – ›Planning concept idea‹ for ›special building‹ design – here the case of Building D

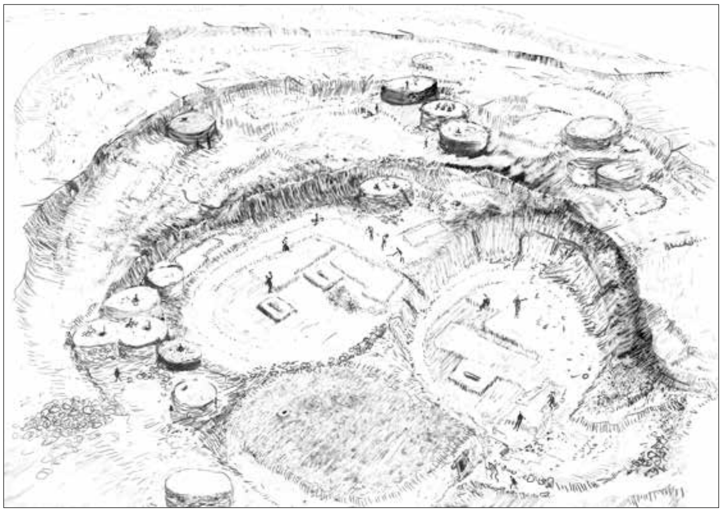

Fig. 9.
Göbekli Tepe: Reconstruction scenario – SE area initial building phase with limestone for pillars etc. quarried on the spot around 9360–8985 cal. B.C.

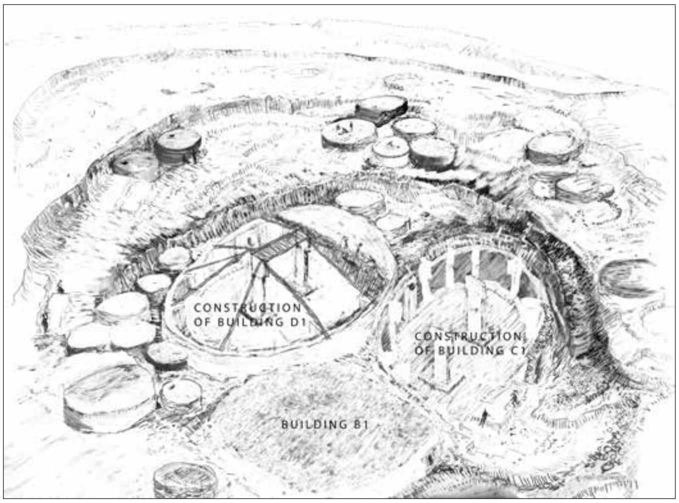

Fig. 10.
Göbekli Tepe: Reconstruction scenario – SE area with the construction site of special building D and C as well as contemporary residential (round house) structures around 9360–8985 cal. B. C.

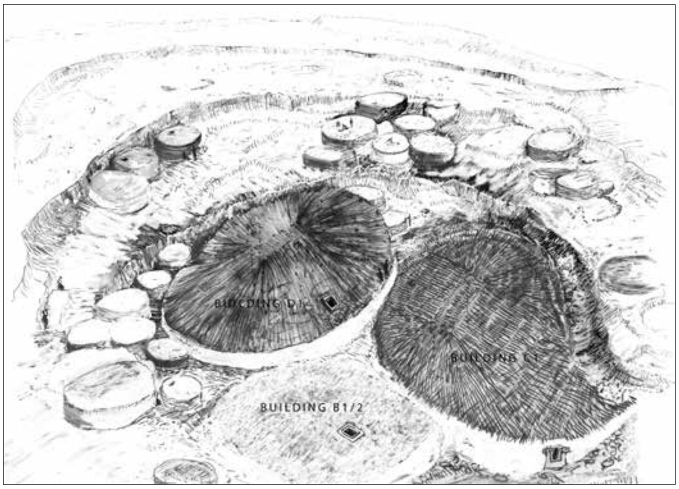

Fig. 11.
Göbekli Tepe: Reconstruction scenario – SE area with the special-buildings B, C and D with contemporary residential round house structures around 9360–8985 cal. B. C. after buildings C and D were »completed«

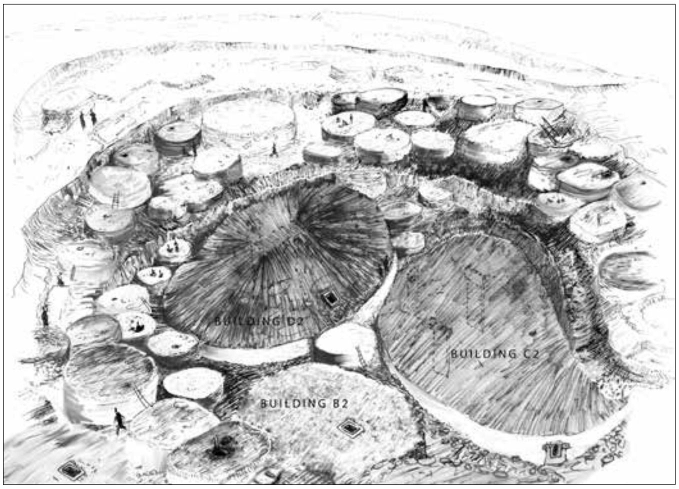

Fig. 12.
Göbekli Tepe: Reconstruction scenario SE area around 8985–8600 cal. B. C. after some modifications at the special buildings and settlement settings

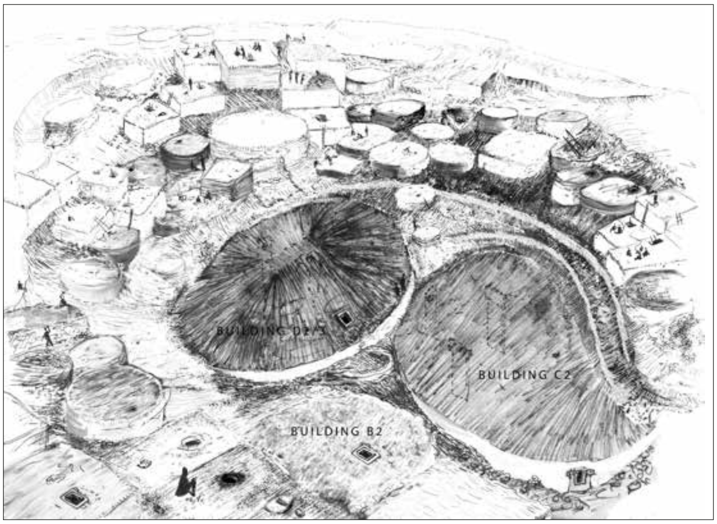

Fig. 13.
Göbekli Tepe: Reconstruction scenario SE area around 8600 cal. B. C. showing the first emergence of rectangular structures and with special buildings slowly surrounded by accumulated sediment

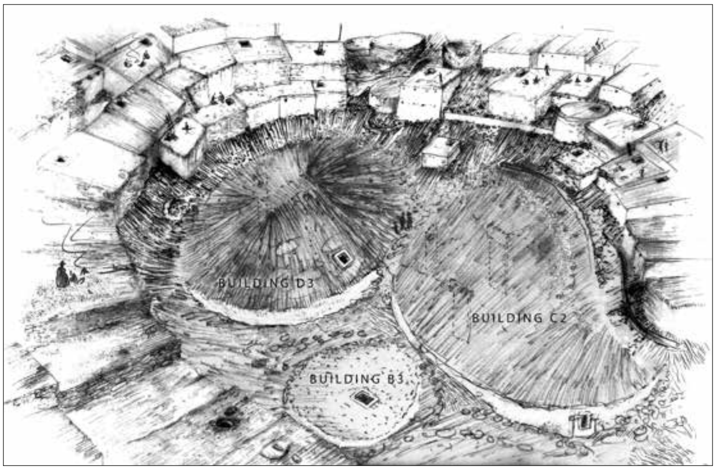

Fig. 14.
Göbekli Tepe: Reconstruction scenario SE area around 8600–8370 cal. B. C. rectangular residential buildings are predominant and the special buildings are surrounded by accumulated sediment

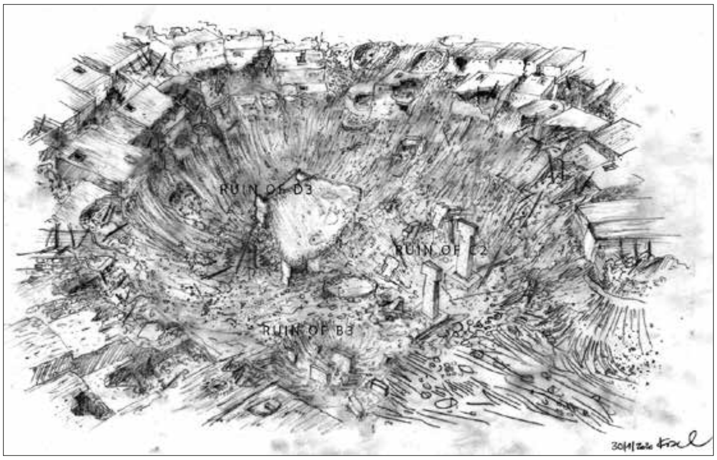

Fig. 15.
Göbekli Tepe: Reconstruction scenario SE area: earthquake triggered slope slide event around 8370–8241 cal. B. C. destroying and damaging major parts of the special buildings and the residential structures on the slopes

Fig. 16.
Göbekli Tepe: Reconstruction scenario SE-area after stabilisation works following the slope slide event around 8241–7795 cal. B. C. with the rebuilding of special building C and the construction of special building G

The plaster floor (Loc. K10-13/23-169) in Structure 1[63] was constructed directly on the exposed bedrock (BR15; Loc. K10-13/23-182). It was reddish-yellowish in colour with small limestone inclusions visible on the smoothed surface. A preparation layer comprised of fist-sized angular stones (Loc. K10-13/23-169.1) served to compensate for the uneven surface of the bedrock. While this rough levelling layer was the base for the finer floor plaster, the wall of the structure (Loc. K10-13/23-151) was constructed on top of foundation layer Loc. K10-13/23-200 and K10-13/23-169.1. Both were constructed directly on the bedrock, and the floor and wall on top of them. The wall of Structure 1 may have created a ›sediment trap‹ for soil that accumulated against the eastern exterior of the building. It is upon the latter accumulations that Structure 3 stands; up to 0.50 m of soil (Loc. K10-13/23-166.2–K10-13/23-166.5[64]) was excavated below this structure before the bedrock (Loc. K10-13/23-183) was reached. Following the erection of Structure 3, sediments accumulated behind its walls. Although this building may have been partially cut into existing soil deposits, the presence of other buildings in its close vicinity (Structures 7, 8, 9 and 10), makes it more likely that a sediment trap was created between the different structures, which would better explain this particular context[65].

63 In the original end of season archive reports (Sönmez 2017; Yelözer 2015), Structure 1 is described as a series of superimposed buildings: S1, S2, S11 and S13. However, the thorough assessment conducted during the post-excavation evaluation of the data led to the re-interpretation of the (possible) PPNA structures as presented here (Lelek Tvetmarken 2018).

64 Loc. K10-13/23-166 includes the floor (Loc. K10-13/23-166.1) and four spits excavated off the deposit below it (Loc. K10-13/23-166.2 – K10-13/23-166.5).

65 Based on the documentation, three scenarios are possible: A) Structure 1, built directly on the bedrock, was built before Structure 3. The exterior wall of Structure 1 served as a sediment catcher and Structure 3 sits on these deposits and is built against the exterior of Structure 1; B) Structure 3 is actually built earlier, sitting on the natural soil cover of the rock-scape. Structure 1 is erected later, cutting into Structure 3 and underlying, earlier deposits, down to bedrock. In this scenario, both structures could be semi-subterranean as they had been cut into the sloping surface; or C) Structure 1 is actually the earliest structure, which had been built on the bedrock. At around the same time Structure 3 had been built. Structure 1 was then later replaced by Structure 2, which was still using the floor of Structure 1 and its wall as foundation. During the construction of Structure 2, Structure 3 was cut and parts of its floor removed in order to build a niche into the eastern wall of Structure 2. At the moment, option C seems to be the most plausible scenario.

Structure 9[66] and its successors (Structures 10[67], 11[68] and 12[69]) stood on the same rock outcrop (Loc. K10-13/23-210). The latter rock surface (BR17) is quite uneven and slopes down from north to south[70]. Numerous large limestone boulders[71] (Loc. K10-13/23-202.1) were used in an effort to minimise the impact of the sloping rock relief, thus providing a more horizontal building surface. On top of the boulders was a layer of limestone slabs (Loc. K10-13/23-202). These roughly-shaped slabs suggest a certain degree of solution-oriented pre-planning and detailing. Notably, the slabs are not a floor but serve as the foundation and preparation layer for the finer, compacted mud-plaster floors in Structure 9 and the later Structure 10, which had been constructed inside the former (earlier) structure; only the plaster floor in the later Structure 10 has been preserved (Loc. K10-13/23-207). It is possible that the plaster floor in Structure 9 was removed or destroyed when Structure 10 was constructed. The floor itself (Loc. K10-13/23-207) had been constructed on a foundation containing an exceptionally high frequency of chipped stone (Loc. K10-13/23-201). This is a remarkable feature in its own right and will be published elsewhere[72].

Rock surfaces were also exposed in other spots in the Northwest Area. Building K10-55 is the most unusual structure discovered at Göbekli Tepe thus far[73]; the entire volume of the building seems to have been cut from the bedrock and its surfaces carefully smoothed (BR22). Rock surfaces were exposed southwest (BR20) and northwest (BR21) of this building. Its builders may have taken advantage of a natural depression in the rock surface, which they then proceeded to extend. As only a limited part of this building has so far been excavated, its purpose and function remain open to speculation[74]; a preliminary interpretation is that it was a water reservoir or cistern. Be this as it may, Building K10-55 provides crucial insights into the visibility of the rock surface during the PPN occupation at the site.

Rock surface have also been found at two further spots in the northwestern part of the tell (*figs. 17. 18*):

1) In the northeastern corner of trench K10-35, excavations revealed a northwest-southeast oriented channel (Loc. K10-35-22) cut into the natural bedrock (BR18; Loc. K10-35-21). A special feature of this channel was a limestone cover made of vertical upright stones and horizontally laid slabs[75].

2) In trench K10-54, a sounding revealed another rock cut channel, though not as carefully worked as the one in trench K10-35. This north-south oriented channel appeared to widen at its southern end, where it disappeared into the section of the trench (BR19).

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66 In the interim report this structure is referred to as Structure S8 (Sönmez 2017).

67 As above, previously referred to as Structure S6.

68 As above, previously referred to as Structure S7.

69 This structure was referred to earlier as structure S9. Structure 12 actually comprises two building phases: 12.1 (earlier) and 12.2 (later).

70 The rock surface slopes down from 772.87 m in the north to 772.41 m in the south.

71 The boulders and stone slabs measure between 80 × 40 × 60 cm, 50 × 30 × 30 cm, 70 × 60 × 50 cm and 60 × 80 × 50 cm (Sönmez 2017).

72 Breuers in prep.

73 It could, for good reasons, be called a ›special building‹, as it is, up until now, the only one if its kind.

74 See Clare 2020; a more detailed study will be published elsewhere.

75 Dietrich et al. 2014, 5–6. The height of the bedrock surface is documented between 774.44 m and 774.30 m (K10-35 excavation diary 2013).

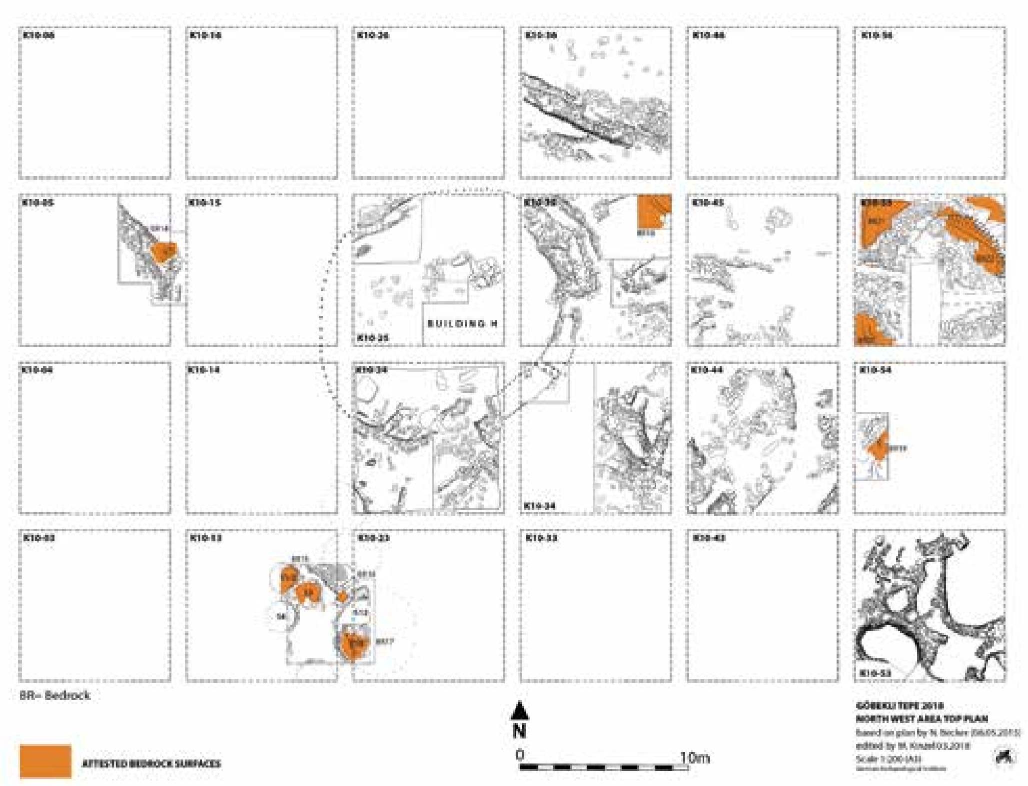

Fig. 17. Northwest Area with attested bedrock surfaces (in orange)

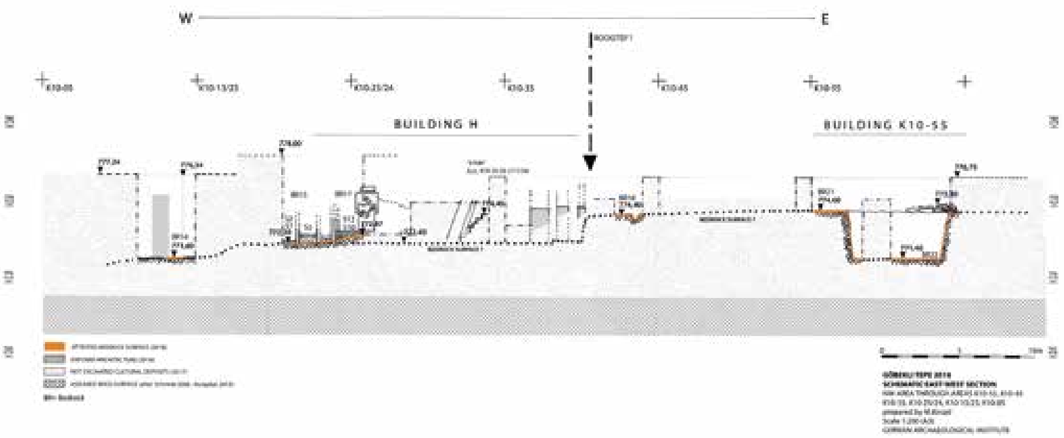

Fig. 18. E-W section through the Northwest Area: attested and reconstructed rock formation

Bedrock	Trench	Feature	Level (m a.s.l.)
BR14	K10-05	Rock surface	~771.60
BR15	K10-13/23 Loc. K10-13/23-182 and K10-13/23-183	Rock surface under Structures 1 and 2	772.34–772.42
BR16	K10-13/23 Loc. K10-13/23-241 and K10-13/23-254	Rock surface under Structures 8 and 7	772.98
BR17	K10-13/23 Loc. K10-13/23-210	Natural bedrock under Structure 11	772.41–772.87
BR18	K10-35	Rock surface with channel	~773.50
BR19	K10-54	Rock surface with channel	~774.30
BR20	K10-55	Worked rock surface	774.39
BR21	K10-55	Worked rock surface	774.60
BR22	K10-55	Worked rock floor in Building K10-55	771.40–771.53
BR23	DR2 Loc. DR2-155 (tank area)	Rock surface	767.489–767.866
BR24	Building E	Worked rock surface (floor)	771.58–772.26
BR25	North of Building E	Rock surface	774.40
BR26	L10-78	Worked rock surface (floor)	769.46

Table 2 Rock surfaces attested at Göbekli Tepe outside the SE area

Building H is the largest structure exposed so far in the northwestern part of the site[76]. The floor level of this monumental round-oval building remains unexcavated but is likely to correspond with a low-lying rock platform. A narrow stairway (Loc. K10-24-20.10/11/34), located in the southeastern part of the building, appears to lead downwards into the interior of the building. The elevation of the rock surface exposed in trench K10-35 (Loc. K10-35-21) can only serve as an indicator of the rock-scape east of Building H. The rock surfaces in trench K10-13/23, located southwest of Building H, could indicate the expected floor level in the building, which may be at an elevation of around 772.40 m. The top levels of the T-shaped pillars in Building H suggest similar heights when reconstructing possible roofing and the foundation level of the pillars. The exposed steps of the stairway currently bridge a height difference of about 55 cm, but, as it has not been fully uncovered, there is a great chance that there are more steps, which may bridge the height difference of about 1 m between the surrounding rock surface and the interior of the building.

Additional insights relating to the underlying rock-scape in this part of the tell come from recent excavations on its western slope, which were undertaken in preparation for the installation of a rainwater drainage channel for the second of the newly constructed protective shelters. Drainage channel 2 (DR2) is an approx. 35 m long and 1 m wide trench oriented east-northeast to west-southwest, which extends down the western slope of the tell from trench K10-05 to the base of the mound. At the western end of DR2, excavations of a 3.30 × 5 m large area for the installation of water tanks revealed the rock surface (BR23; Loc. DR2-155) at an elevation of

[76] Dietrich et al. 2016; Waszk 2017.

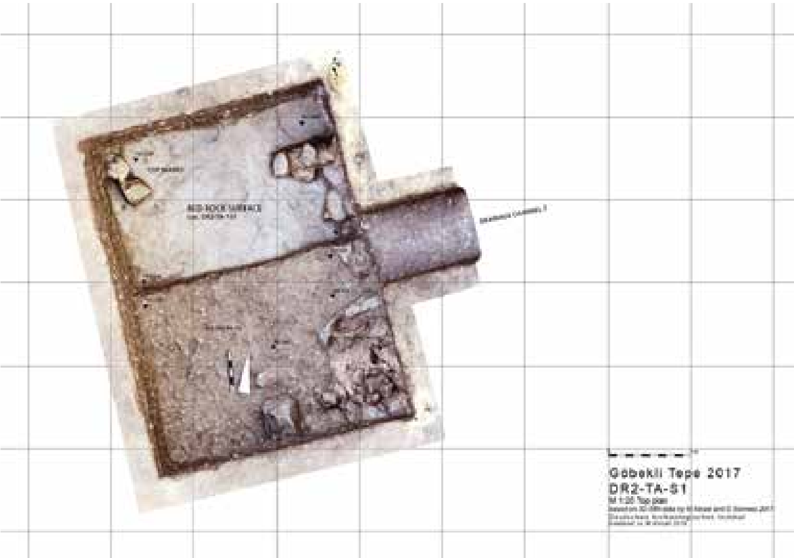

Fig. 19.
Göbekli Tepe, DR2 rainwater collection tank area with rock surface and structure DR2-S1

767.489 to 767.932 m, i. e. more than 3.50 m lower than in trench K10-05 (BR14; 771.60 m). Excavations in this tank area also led to the discovery of a small structure (DR2-S1) constructed on a foundation layer consisting of fist-sized stones and clayey soil containing animal bones (Loc. DR2-135), which provided a stabilized surface up to 15–20 cm above the rock surface (*fig. 19*). Although the underlying plateau was only visible in the tank area, the foundation stones of structures DR2-S2 and DR2-S3, located further upslope, may suggest that the rock surface is to be expected at an elevation of 770.85 m +/- 35 cm in this location[77]. Partial confirmation of observations in the northwestern part of the tell comes from geophysical surveys[78] undertaken before the onset of excavations in this area[79]. Regrettably, although the cross-sections from the geo-electric tomography do show the bedrock below the archaeological layers, any interpretations of this data are limited, primarily due to interferences and interpolated data at both ends of the section in a range of about eight to ten metres (*fig. 20*). In other words, the data is only reliable in the areas of the ›hollows‹ and not on the investigated slopes. Furthermore, due to the research questions raised by K. Schmidt at the time, the geo-electric survey did not extend into those areas of the site, i. e. the slopes and mounds, which would have contributed to a better

77 This assumption is based on our experience from other trenches, e. g. K10-13; L9-58; L9-78 and DR2-TA were compacted mud floors of round structures were established directly on the bedrock or on a coarse base layer made of lithic debris or fist-sized stones of about 10 to 30 cm.

78 Geophysical surveys were carried out in 2003, 2006, 2007 and 2012 by the GGH – Solutions in Geosciences Freiburg. Magnetic prospection was conducted over several large-scale areas of the mound and ground-penetrating radar mapping applied in selected areas. Additionally, geo-electric resistivity tomography sections were executed in relevant areas. For the ground-penetrating radar, a system by GSSI, *TerraSIRch 3000* with a 200 MHz Antenna and a profile distance of 0.5 m was used. The geo-electric resistivity tomography was executed with a Multi-electrodes-tool *4point light hp* made by LGM with a 80 Electrodes-line. The measurements were run with a Dipole-dipole-constellation with a distance of 1 m.

79 Cf. Dietrich et al. 2016.

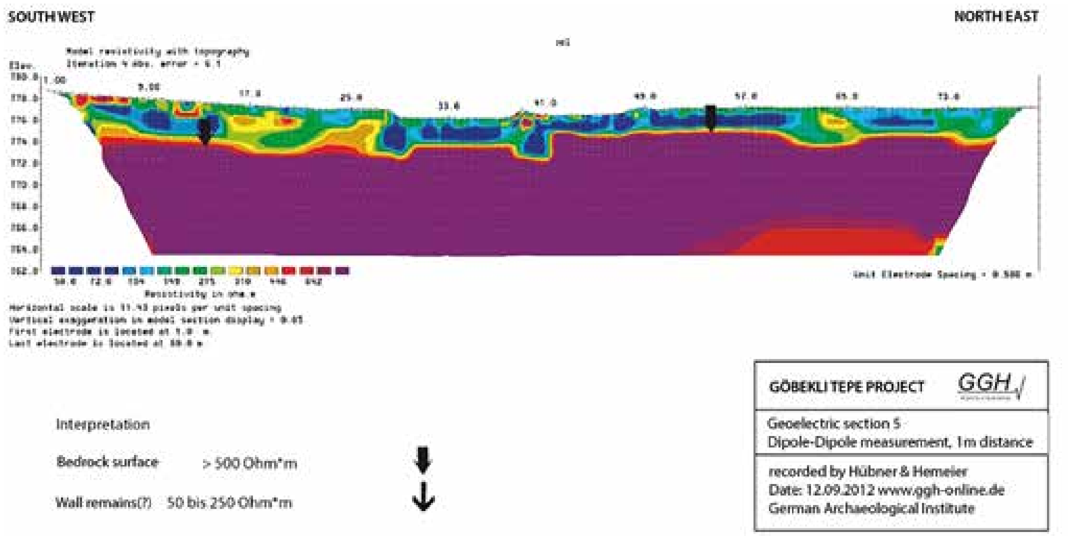

Fig. 20. Geo-electric Tomography: section 5 in logarithmic colour-coding of specific resistances; E-W running section through the Northwest Hollow

understanding of its topography. Equally frustrating is the fact that the architecture excavated in areas covered by the earlier geophysical surveys only partially resembles the images produced in these studies. In order to clarify this discrepancy, additional geophysical survey work and targeted excavations must form a crucial part of future investigations in this area.

New findings relating to the rock surface in the northwestern part of the site suggest that the rock relief here is not as pronounced as in the Southeast Hollow, though significant steps in the rock-scape are still apparent (*figs. 18. 20*)[80]. A considerable ridge probably lies below unexcavated sediments in trenches K10-34 and K10-35. While the rock surface is very close to the present day surface in trench K10-55 to the east of these trenches, to the west it lies under at least five metres of deposits. At the southern periphery of the Northwest Hollow, sediment depths increase dramatically. For example, the bedrock beneath the small roundhouse structures in trench K10-13/23 lies 5.5 m below the present surface of the site[81], and in trench K10-05 the rock surface (BR14) appeared at around the same elevation (771.60 m). As the fieldwork in the Northwest Hollow is still at an early stage, interpretations must remain preliminary. In addition to the areas of the tell with attested rock surfaces, visible rock outcrops also provide valuable information for the reconstruction of the original rock relief.

[80] For the attested rock surfaces, the differences are not that evident: the elevation difference in 50 m (between K10-05 and K10-55) is about 3 m, which is only slightly less than in the Southeast Hollow (between L09-69 and L09-84) were the surface slopes about 3.50 m over a distance of about 45 m.

[81] Sönmez 2017.

Fig. 21. BR24: Bedrock at Building E

Fig. 22. BR25: Bedrock surfaces with cupmarks north of Building E

Attested Rock Surfaces in other Areas

The worked rock surface inside Building E[82], located at the southwestern edge of the mound, provides an elevation for a still existing Neolithic floor (BR24) at 771.58 m (*fig. 21*). The surface immediately north of the interior of this building is at an elevation of 772.26 m, though quarrying activities during later periods could have resulted in the removal of some of the banked limestone layers outside the structure. About 35 m northeast of Building E, the rock surface (BR25) features a series of cupmarks, which disappear below the cultural deposits of the tell (*fig. 22*). Here the rock surface is at an elevation of about 774.40 m, which corresponds to the height of the rock surface in trench K10-55.

A sounding (2 × 1 m) excavated in 1997 in trench L10-78 (BR26) in the Northeast Hollow reached the bedrock at an elevation of 769.46 m, which is about four metres below the current ground surface at 773.50 m[83]. The bedrock showed the same treatment as the rock surfaces in Buildings C and D in the southeastern area, indicating that it was part of a building interior. The exposed bedrock surface here corresponds in height with the interior floor surface in Building C, indicating a major height difference of 5.14 m between it and the bedrock surfaces around Building K10-55 (774.60 m) in the northwestern area and about 2.20 m difference with the floor surface in Building D. The worked bedrock surface in trench L10-78 indicates the bedrock level in the Northeast Hollow.

The surrounding rock surfaces of the plateaus also indicate that there are considerable cliffs or slopes under the tell. While on the northern slope the height difference between point BR22 and PL13, which are about 150 m apart, is only 3 m, the elevation difference between point BR23 and PL46 located on the northeastern slope, with a distance of about 100 m, is around 10 m. Taking the shorter distance and the larger height difference in account, this indicates a much steeper slope or steps in the rock formation (*table 3* and *fig. 23*).

82 Beile-Bohn et al. 1998; Piesker 2014, 46–50.

83 Schmidt 2000, 37. The height is calculated based on the drawing of the eastern section of the sounding (drawn on the 8.10.1997 by Pisti Szenthe). The topmost surface level has obviously been added to the original drawing at a later point. Unfortunately, no further documentation from this sounding could be retrieved from the archive.

Name	X	Y	Z	Natural
BR1	962.97	974.23	771.650	No (worked)
BR2	981.44	961.97	769.40	No (worked)
BR3	956.859	972.555	772.72	Yes
BR4	961.299	980.100	772.32	Yes
BR5	978.317	980.321	771.63	Yes
BR6	979.30	965.60	769.54	?
BR7	991.008	966.482	770.60	Yes
BR8	989.90	960.70	769.55	?
BR9	985.000	946.500	769.79	Yes
BR10	988.209	939.884	768.89	Yes
BR11	972.299	937.392	769.53	Yes
BR12	973.20	940.20	769.68	?
BR13	961.40	949.40	770.95	?
BR14	808.682	1045.366	771.55	Yes
BR15	816.187	1025.402	772.268	Yes
BR16	820.187	1025.402	773.045	Yes
BR17	820.187	1021.402	772.68	Yes
BR18	837.466	1048.670	773.40	Yes
BR19	851.187	1033.053	774.55	Yes
BR20	850.837	1040.877	774.39	?
BR21	851.365	1047.506	774.60	?
BR22	855.273	1048.628	774.40	Yes
BR23	772.397	1035.966	767.54	Yes
BR24	824.630	903.580	771.90	Yes
BR25	840.50	941.60	777.40	Yes
BR26	975	1075	769.46	Yes
PL1	705.259	1427.847	760.00	Yes
PL2	701.614	1405.175	760.80	Yes
PL3	704.405	1398.091	760.00	Yes
PL4	1003.178	1406.48	747.070	Yes
PL5	661.027	1378.717	762.22	Yes
PL6	859.333	1294.729	760.00	Yes
PL7	807.306	1289.888	762.00	Yes
PL8	840.126	1269.395	765.20	Yes
PL9	766.672	1251.913	767.80	Yes
PL10	799.016	1229.036	769.40	Yes
PL11	868.506	1254.328	765.850	Yes
PL12	869.613	1251.930	765.80	Yes
PL13	822.954	1189.195	771.00	Yes
PL14	667.716	1187.597	759.09	Yes
PL15	749.497	1162.646	768.290	Yes
PL16	701.211	1153.478	757.50	Yes
PL17	726.518	1142.50	763.00	Yes
PL18	720.764	1135.568	758.00	Yes
PL20	698.484	1128.594	750.00	Yes
PL19	707.438	1132.767	754.00	Yes
PL21	733.617	1092.968	760.00	Yes
PL22	731.992	1085.502	752.00	Yes
PL23	710.553	1062.653	746.00	Yes
PL24	713.116	1059.934	746.00	Yes
PL25	714.997	1051.431	746.00	Yes
PL26	745.240	1049.241	762.84	Yes
PL27	633.371	1021.614	716.690	Yes
PL28	721.562	974.217	762.00	Yes
PL29	705.735	931.910	765.00	Yes
PL30	710.811	907.585	767.0	Yes
PL31	654.953	890.552	761.080	Yes
PL32	723.833	875.497	768.50	Yes
PL33	757.506	880.294	770.600	Yes
PL34	762.092	797.531	764,18	Yes
PL35	667.308	662.355	750.960	Yes
PL36	921.176	737.627	714.240	Yes
PL37	1117.91	814.748	765.00	Yes
PL38	1162.524	822.066	765.10	Yes
PL39	1128.408	808.450	766.590	Yes
PL40	1172.858	808.775	765.50	Yes
PL41	1134.666	771.787	767.00	Yes
PL42	1135.187	721.936	767.00	Yes
PL43	1167.464	720.951	767.50	Yes
PL44	1100.448	677.075	765.610	Yes
PL45	1112.703	570.638	767.480	Yes
PL46	1073.491	1115.559	759.020	Yes
PL47	1202.07	1224.774	746.530	Yes
PL48	1255.88	1196.382	744.840	Yes

Table 3 Göbekli Tepe: Rock surfaces mentioned in text shaded in grey (*fig. 23*)

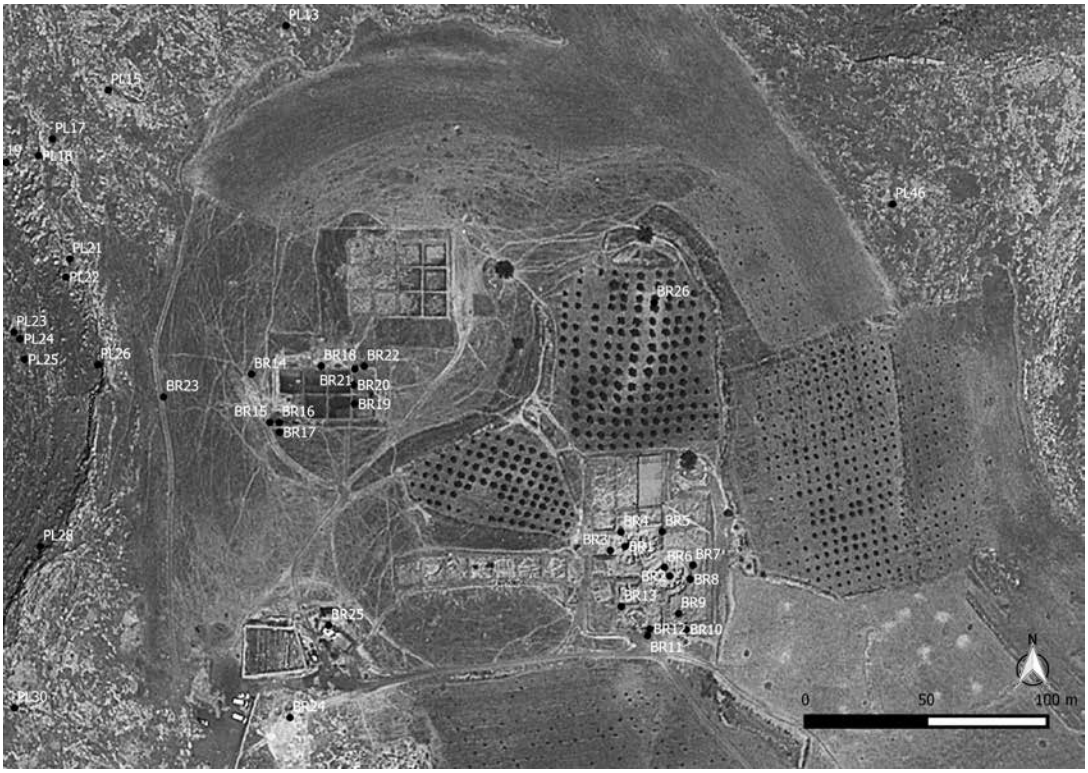

Fig. 23. Göbekli Tepe: elevation points of rock surfaces plotted on aerial images

Regional Comparison

To understand the original setting of Göbekli Tepe, it is also worth considering neighbouring hills and those forming parts of adjacent mountain ranges. Many of these hills feature steep slopes, rock outcrops and plateaus. Notably, the plateaus are rarely flat but display quite diverse and irregular surfaces with embedded soil accumulations and deposits (*fig. 24*). Göbekli Tepe lies in the Germuş Mountains, a chain of limestone hills dating back to the Miocene. The regular and uninterrupted limestone formations are visible not only from the lower-lying plains but also in satellite images. Each bench of limestone lies atop a larger one and carries upon it a smaller unit until each hill in the chain reaches its peak. Even at their summits, rock surfaces are rarely flat as is evident from many of the hilltops in the Germuş range and other Eocene and Miocene limestone formations in the region. As such, it is unlikely that the surface of the limestone plateau now covered by the mound at Göbekli Tepe was ever flat. Located 37 km southeast of Göbekli Tepe, Karahan Tepe may provide further evidence relating to the appearance of the original rock surface at Göbekli Tepe. Karahan Tepe is a PPN site in the Tektek Mountains, on the eastern flank of the Harran Plain[84]. Archaeological surface surveys have already recovered a range of finds,

[84] Çelik 2000.

Fig. 24. Göbekli Tepe: steps in the rock escarpment and traces of quarrying on the southwestern plateau

including T-shaped pillars, broken sculptures and arrowheads, which display significant similarities to Göbekli Tepe. The landscapes surrounding the two sites are also similar and both lie upon a Miocene limestone formation. However, instead of crowning a limestone hill (as at Göbekli Tepe), Karahan Tepe is spread across a valley between two hills, continuing up the slopes and covering parts of one of the hilltops. Except for some cup marks and cisterns, the limestone surface of this hilltop seems to be natural, characterised by an uneven and undulating surface. A very similar setting can be found at Harbetsuvan Tepesi, a smaller PPNB(?) site located 7 km southwest of Karahan Tepe, on the fringes of the Tektek Mountains, which has been described as »the best location for overlooking the Harran Plain«[85]. The archaeological remains also form a low mound resting upon the limestone plateau. As such, it may resemble the original limestone plateau beneath Göbekli Tepe.

Conclusion

Understanding the original site topography at Göbekli Tepe has significant implications for the development of diachronic settlement reconstruction scenarios. In this contribution, we have collated the available data to test existing models and to provide the basis for alternative approaches. If the assumption that the buildings and their respective locations are a reflection of the original rock-scape, i. e. with a stepped relief, is correct, this leads to a plethora of further questions. For example, can we still refer to the large special buildings as subterranean buildings, seeing as they appear to be built on the bedrock and not cut into deposits, and that they were surrounded by other buildings and not by earth? Indeed, this does not even take into account that in densely packed Neolithic settlements it is hard to say where we are within the settlement or a building – outside or inside a house[86]. In the context of Göbekli Tepe, we must also ask how one may best define ›subterranean‹. Is everything below the ›communication level‹, i. e. the roof, subterranean? And if not, how might one refer to it? In contrast to the buildings in the hollows, the flanks of the mounds feature steep slope architecture. This kind of architecture is highly complex, making it extremely difficult to define building units using ›split-level‹ concepts[87]. In this context, we need to emphasise the (possible) evidence for two-storey PPNB buildings at Göbekli Tepe. The presence of two-storey buildings may explain the large amounts of building debris in the fill of the monumental structures and the good preservation of the still remaining

[85] Çelik 2016, 422.

[86] Duru 2013; Barański 2017; Barański et al. 2015; Kinzel 2013, 20–32; Kinzel et al. 2020.

[87] Kinzel 2004. Under ›split-level‹ we can understand architecture where neighbouring spaces with floors at different heights share walls. ›Split-level‹ spaces are connected by passages (Gebel 2006, 220; Kinzel 2004, 18–19).

parts of the architecture after 10,000 years. One case could be a building in trench L9-80 (spaces 16, 18, 42 and 96), previously pointed out by E. Banning[88]. Here space 16 is preserved in its full height and is superimposed by the slightly larger space 42. About half of the upper storey is still preserved and the floor of the upper storey would have been carried by a wooden construction resting on the T-shaped pillars PVII, PVIII, PX and PXI, as well as on the support preserved on the enclosing walls. The building shows at least three building phases: an early roundhouse structure that was remodelled into a rectangular building. This building was at a later point renovated by blending an additional wall face in front of the earlier one and reducing the size of the interior space. This structure will be discussed in detail elsewhere[89]. Notably, similar patterns of steep slope PPNB architecture have been found in the southern Levant[90]. Finally, it should also be noted that back in 2003, K. Schmidt briefly discussed the potential source of the aforementioned backfill material excavated from within the monumental buildings, which, as he observed, was not sterile but included cultural debris[91]. Our recent studies of the PPNB architecture, as pointed out above, could explain the origins of this material, namely that it contained rubble from collapsed buildings on the high-lying mounds and slopes at Göbekli Tepe.

It is hard to say what could have triggered a slope slide. We have already suggested a possible scenario above. Another possible explanation is an earthquake, but evidence for this type of natural catastrophe is normally vague[92]. An exception to this may be the observed tendency for the T-pillars found at the site to have fallen in the same direction, which may imply a (possible) westward oscillation during such an event[93]. Another argument in favour of earthquake impact could be the absence of upper stories or upper building parts, their rubble-stone masonry[94] having been most exposed to the seismic loads[95].

With the results from the deep soundings, we have begun to understand the nature of site formation processes at Göbekli Tepe (*figs. 7–16*). The mountaintop is not a flat plateau as previously postulated but has a very distinct relief, and it was this relief that dictated the site topography we see today. The implications of these results are manifold:

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88 Banning 2011.

89 Kinzel et al. in prep.

90 Kinzel 2013, 222–232.

91 »Sedimentological analysis was done at one square meter in the east baulk of area L9-68 in a 4 m deep column from the topsoil down to the bench of enclosure D, in order to find out the origin of the filling debris. It is not sterile soil; it includes a lot of EPPNB and PPNA artifacts, animal bones and other finds typical of settlement debris, but it is not clear where the enormous amount of debris had been taken from« (Schmidt 2003, 7).

92 In their study of damages in the PPNB layers at Tell es-Sultan, L. Alfonsi et al. (2012) investigated possible seismic events along the Dead Sea fault. They identified at least two seismic events, one around 7,000 B.C. and another around 6,000 B.C. Their observations also provided indications for an earlier event that affected the PPNA layers (around 7,500 B.C.). For general observations see Bosch – Carrara 2016.

93 For the behaviour of buildings affected by earthquakes, see Sieberg 1904; 1922; Jung 1938; McCalpin 1998; as well as Meskouris et al. 2007. For earthquake-induced landslides, see the study by Ambraseys – Bilham (2012). For a general study regarding the impact of earthquakes in the Urfa region, see Cıvış 2012; as well as Kriete 2013.

94 After Meskouris et al. (2007, 139) rubble stone masonry and mudbrick masonry structures have the highest degree of likelihood to suffer damage during earthquakes.

95 Sieberg 1904, 115; Meskouris et al. 2007, 139. In the framework of the ongoing building archaeological study, a detailed recording of possible earthquake damages at Göbekli Tepe is also taking place and will be presented elsewhere.

1) Cultural deposits at the site show a large variety of stratigraphic depths due to the underlying rock formations.
2) Building locations were (initially) chosen based on topographical rock parameters.
3) Banked limestone was exploited on the entire hilltop and not only along the edges of the plateau as previously posited[96].
4) Natural erosion products from limestone formations provided most of the essential building materials (e.g. fist-sized stones, wall stones of various sizes and pre-forms for larger elements).
5) If the limestone building material, including large elements such as T-pillars, was quarried ›on the spot‹, this could indicate that smaller numbers of people were needed in the construction process of the larger buildings (e.g. reduced transportation efforts etc.) than hitherto discussed.
6) The initial character of the building design was not subterranean as such; structures stood on the rock surface with an at least partial exterior façade. This is also suggested by the observed patterns of wall collapse in K10-13/23, indicating that the walls were free-standing and no soil deposits were surrounding the exterior walls. This is especially well documented for the southern wall segment of Structure 8[97].
7) Buildings acted as sediment catchers, which culminated in the accumulation of deposits outside the structures that has created the impression of subterranean buildings.
8) The fill of a number of buildings could be predominantly erosional products with some anthropogenic interactions. We have to assume that there are different infilling processes represented at the site, with some buildings apparently having been filled in with collapse (only) and others having partially collapsed in on themselves and then subsequently been filled in by various deposits (erosional, refuse, etc.). Heavily damaged retaining walls and evidence for re-occurring repairs seem to tell a story of a series of slope slide events with subsequent consolidation attempts.
9) Each building has its individual building and filling history. What happened to one building cannot be used as a blueprint for all buildings. There may be similar processes taking place, but not necessarily at the same time.

Planned future studies will enhance our current understanding of the underlying topography at Göbekli Tepe; these will include core drilling and geophysical prospection in previously unexplored parts of the tell, including the steep southern slope adjacent to the Southeast Hollow and the tops of the mounds. Additionally, slope slide simulations might provide further insights into site formation processes. Be this as it may, our most recent observations are an active contribution, albeit a ›bottom-up‹ approach, to the ongoing debate concerning the stratigraphy and site formation at Göbekli Tepe.

[96] Cf. Kurapkat 2015; Schmidt 2009.

[97] Lelek Tvetmarken 2018.

Abstract: Göbekli Tepe has always been described as an anthropogenic mound comprised of archaeological deposits that had accumulated upon a flat limestone plateau. In light of recent studies, however, we are forced to reconsider this interpretation. It is now apparent that the present relief of Göbekli Tepe is dictated by, and therefore intrinsically related to, the underlying rock-scape. This rock relief was a decisive criterion in the choice of this particular location for the construction of the monumental buildings and a determining factor for later site formation processes. In this contribution, we will discuss possible scenarios for the reconstruction of the palaeo-relief at Göbekli Tepe.

Auf Fels gebaut – Ein Rekonstruktionsversuch der ›neolithischen‹ Topographie des Göbekli Tepe

Zusammenfassung: Der Göbekli Tepe ist bisher immer als ein von Menschen geschaffener Siedlungshügel auf einem flachen Kalksteinplateau beschrieben worden. Doch diese Interpretation muss im Licht der neusten Forschungen revidiert werden. Dabei wird deutlich, dass die heutige Erscheinung des Fundplatzes stark vom unterliegenden Felsrelief beeinflusst ist. Dieses gestufte Felsrelief war offenbar auch ein grundlegendes Kriterium für die Standortwahl zum Bau der Sondergebäude und hatte entscheidenden Einfluss auf die späteren Formationsprozesse am Fundplatz. In diesem Beitrag präsentieren und diskutieren wir unsere ersten Überlegungen zur möglichen Rekonstruktion des Paläoreliefs, der Formationsprozesse und der Bauten im Hauptgrabungsgebiet am Göbekli Tepe.

Kaya üstüne inşa edildi – Göbekli Tepe'deki ›Neolitik‹ topografyanın rekonstrüksiyonuna doğru

Özet: Göbekli Tepe daima düz bir kireçtaşı plato üzerinde birikmiş arkeolojik dolgulardan oluşan bir höyük olarak tanımlanmıştır. Ancak son çalışmaların ışığında, bu yorumu yeniden gözden geçirmek zorundayız. Göbekli Tepe'nin mevcut topografyasının, altında yatan ana kaya tarafından belirlendiği ve bu nedenle özünde bununla ilişkili olduğu artık belirgindir. Kaya yüzeyinin biçimi anıtsal yapıların bu belirli konumda inşa edilmelerinde belirleyici bir kriter ve yerleşmenin daha sonraki oluşum sürecinde etkin bir faktördü. Bu yazıda Göbekli Tepe'deki geçmiş topografyanın yeniden oluşturulması için muhtemel senaryoları tartışacağız.

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