Report and Catalogue of the Amber found at Bernstorf, near Kranzberg, Freising district, Bavaria, Germany

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1 Introduction

The subject of this report and catalogue is the amber discovered at Bernstorf, Freising district, Bavaria, Germany between 1997 and 2005. 56 pieces of amber were recovered over a period of nine years. Of these, 50 were studied by the author in October 2014 at the State Archaeological Collection in Munich (ASM)[1]. This opportunity was very kindly provided by Professor Rupert Gebhard[2], ahead of the conference on the Bernstorf gold and amber held at the Archäologische Staatssammlung[3]. Three of the amber pieces were made available by Vanessa Bähr[4], who had them in her care at that time. The amber and gold from Bernstorf are perhaps some of the most interesting finds from the Bronze Age in southern Germany. From the outset, however, the finds have been dogged by controversy with questions being raised about their authenticity. The lead authors of the 2016 Bernstorf volume[5] insist that their authenticity and Bronze Age date can be conclusively settled[6], on the basis that "not a single sound argument can be identified supporting the assumption that we are dealing with forgery"[7]. At the present time, members of the archaeological community on both sides of this often heated debate remain deeply divided in their acceptance of the evidence presented by their opponents. This has not been helped by the rather disparate publication history of the site and its finds which has made it difficult for those not intimately involved to build a coherent picture of the situation. Most previous publications have confined themselves to a single, or limited range of topics; the exception being the popular

1 Gebhard/Krause (2016, 123) state that only 20 amber objects were seen by the author, but this is a misunderstanding based on the fact that the present catalogue provides only one catalogue number for each group of small, unworked amber items which have the same ASM accession number. The outstanding six pieces (the five pieces of catalogue B02a; the sixth piece outstanding has ASM Inv. No. 197 and is in addition to the other two pieces with that same inventory number (catalogue B14 and B15)) were not available for study in October 2014.

2 Archäologische Staatssammlung, München (ASM).

3 'Die Gold- und Bernsteinfunde von Bernstorf – Authentizität und Kontext in der Bronzezeit Europas. Internationale Tagung zum bronzezeitlichen Bernstorf-Projekt der Goethe-Universität Frankfurt und der Archäologischen Staatssammlung, München, 12.–14.10.2014'.

4 Vanessa Bähr, M. A., Goethe University, Frankfurt am Main.

5 Gebhard/Krause 2016.

6 Anon. 2017; Gebhard/Krause 2017.

7 Gebhard/Krause 2016, 151.

8 Moosauer/Bachmaier 2005.

book published in 2005 by Manfred Moosauer and Traudl Bachmaier[8], the principal finders of the gold and amber items.

The aim of this current paper is to contribute to the debate by presenting the amber assemblage as a whole for the first time. It builds on the additional, but still incomplete, information about the amber which was provided in the recent 2016 publication of a collected volume about the archaeology of, and archaeological investigations at Bernstorf[9]. That volume provided the present author with the opportunity to fill in some gaps in information, as well as to review in more depth the interpretations and research which have been ongoing over twenty years. Vanessa Bähr's dissertation (when published) will provide even more clarification[10].

A chronological list of all the amber and gold finds from Bernstorf is presented in Table 1 (see page 186–191).

2 The Bernstorf Berg

The Bernstorf Berg is one of a line of low hills on a bend of the Amper river, north-west of the village of Kranzberg, Freising district in Upper Bavaria. It commands an expansive view over the Amper valley and is strategically placed on a natural north-south routeway linking the Alpine region with the hinterland to the north[11]. That ancient enclosures existed on the hill has been known for around 150 years. The horseshoe-shaped earthwork fortification of the early Middle Ages, known as the 'Schanzel', was first mapped during the 19th century. In 1904/5, Joseph Wenzl first described what he interpreted as a fortified enclosure and extended settlement on the hill[12]. The fortifications from the Hallstatt period and Middle Bronze Age remained unknown until the archaeological excavations in the 2000s[13]. Geologically the hill is composed mainly of Tertiary mixed sands and gravel, overlain with humic material[14]. It has been plantation forested for decades. Today the hill has been partially destroyed by gravel quarrying, which lasted from the 1950s until 2005[15] when it was halted in response to the gold and amber discoveries.

3 Archaeological Activity at Bernstorf between 1994 and 2015

As noted above, the lack of a published comprehensive account of all the various activities at Bernstorf has hindered those not directly involved from being able to build a satisfactory overview of what had occurred. The 2016 Bernstorf publication addressed this issue and provided much more additional detail. Except for a few very minor details[16], the now published accounts given by the ASM[17] and the Bayerische Landesamt für Denkmalpflege (*Bavarian State Office of Conservation,* BLfD)[18] differ only in the strength of

9 Gebhard/Krause 2016.
10 Gebhard/Krause 2016, 45 with footnote 113 and 115. Bähr's dissertation is described as '2017 in press'.
11 Gebhard/Krause 2016, 45.
12 Gebhard/Krause 2016, 54; 55 with footnote 135. Macha et al. 2006 reports Wenzl's handwritten notes in the archives of the Historischen Verein Freising *(Freising Historical Association).*
13 Gebhard/Krause 2016, 56.
14 Röpke 2016.
15 Bähr 2016, 269 with footnote 7.
16 Such as whether a particular third party was present on site on a particular day - Rohde 2016, 283; 285 with footnote 83.
17 Gebhard/Krause 2016, 54–65.
18 Rohde 2016.

focus which the two organisations choose to give to different elements of their narrative. As there have been several organisations involved at Bernstorf, the following is intended as a very brief and neutral synthesis of the chronological sequence of events, including the gold and amber finds. Except where indicated, this list of events is taken from the much fuller account by Claudia Rohde[19].

A- In 1993 (and probably before) Dr. med. Manfred Moosauer[20], later with Frau Traudl Bachmaier († Nov. 2016)[21], was interested in locating local iron smelting sites. At the suggestion of the Archäologischer Verein Freising (*Freising Archaeological Society,* AVF)[22], of which they were both members, they began investigating at Bernstorf in January 1994[23].

B- May 1994. Moosauer begins excavations on the eastern side of Bernstorf hill. Discovers La Tène period kilns and a so-called vitrified wall. Commissions some scientific analyses, which he raises the money to pay for. As he has minimal excavation experience, support given by AVF[24]. Excavation licence granted from 28.05.1994 to 17.06.1997.

C- In 1996, the BLfD instructs Moosauer to keep proper excavation records and asks for all the previous documentation and scientific research results to be handed over. Moosauer says this documentation mainly consists of some 3,000+ colour photographs.

D- February 1997. Moosauer instructed to stop excavating. He replies that he would like to finish what he is currently doing and collate the existing documentation.

E- 27.05.1997. The date in the finds record for the first piece of amber (B01 - Moosauer)[25].

F- End of 1997. Gravel working extended towards the scheduled monument, the 'Schanzel', on the western side of Bernstorf hill. Moosauer requests the BLfD to stop all gravel extraction as he has anecdotal evidence that many archaeological finds are being unearthed and not recorded. The gravel extraction licence was upheld and the appeal against this was rejected in July 1998 (Gebhard/Krause 2016, 151).

G- First half of 1998. The BLfD conduct extensive geophysical survey.

H- July 1998. 31 small, unworked pieces of amber found (B02a and B02b - Bachmaier).

I- 23.07.1998. Moosauer hands over the first part of the documentation to BLfD.

J- 13.07.–05.08.1998. BLfD excavation.

K- 07.–30.09.1998. The gold is found.

L- 22.09.1998. Erwin Neumair († 2015) (Chairman of the AVF) suggests the gold is not Bronze Age.

M- 30.09.1998 *a* and 30.04.1999 *b*. The 'six amber objects' are found (B03 – Moosauer *a*; B04–B08 – ASM *b*).

19 Rohde 2016.

20 A former medical practitioner in Haimhausen, just south-west of Kranzberg. For many years he had been a successful campaigner for the local environment. For that work and his discoveries at Bernstorf, in 2009 he was awarded the Bavarian State gold medal (Merkur 2010) and in October 2010 he was presented with the Order of Merit of the Federal Republic of Germany in Berlin (Bundespräsidialamt 2010).

21 A housewife from Haimhausen.

22 A local archaeological society.

23 Initially with the involvement of the State Office for Geology.

24 Rohde 2016, 277 with footnote 11.

25 See Table 1 for more details on the finds.

N- 13.09.1999–19.09.1999. BLfD excavations (K. H. Rieder, BLfD, Ingolstadt).
O- 28.08.–14.12.2000. Excavations by local archaeological units under BLfD.
P- 11.11./18.11.2000. 'Face' and 'Seal' and small piece of amber found (B09–B11 - Moosauer/Bachmaier).
Q- November/December 2000. Amber found (B12–B14 - Bachmaier).
R- 13.12.2000. Amber found (B15 - Bachmaier).
S- 09.04.–14.11.2001. Excavations by local archaeological units under BLfD.
T- 25.04. and 25.05.2001. Amber found (B16–B18 - Bachmaier).
U- 06.05.–05.11.2002. Excavations by local archaeological units under BLfD.
V- 09.10.2002. Volunteer excavator finds amber (B19 - Theodor Lup).
W- 23.05.–01.09.2005. BLfD excavation.
X- 24.08.2005. Volunteer excavator finds last piece of amber (B20 - Gerhard Mittermaier).
Y- 10.09.–08.11.2007. BLfD excavation.
Z- 2007. Goethe University, Frankfurt am Main (GUF) excavation (Krause, GUF)[26].
AA- 2010–2015. Goethe University, Frankfurt am Main excavations (Krause, GUF).

4 The Find Circumstances of the Amber

The debate over the exact timing and circumstances of events and the actions of the personnel present during the finding of the amber and gold items are well documented in the literature. These issues are described with the use of contemporary or subsequent written records, as well as the personal reminiscences of those actually present at those events. It is not the intention of the present author to enter into that debate[27], but only to describe briefly the physical circumstances of the site in which those discoveries were made.

Over the eleven years during which the excavation campaigns and the recovery episodes took place, gravel extraction on the hill continued and expanded into new sectors. Sometimes the archaeological investigations continued on areas which had already been cleared in advance of the extraction. This clearance consisted of felling the trees prior to earth-moving machinery removing the humic topsoil, pushing it up into long heaps of earth. These mounds were completely entangled with the stumps and roots of the trees that had covered the hill. Large areas of the site were scraped clear[28]. One of these earth/root mounds was designated as "Fläche 3"[29] *(Area 3)*[30]. Moosauer and Bachmaier were requested by the then excavation director, Karl Heinz Rieder (BLfD), to explore the cleared areas and earth/roots mounds to see if they contained any archaeological finds or other evidence which might otherwise go unrecorded[31]. This work was done on a voluntary basis, as their time schedules permitted[32]. In

26 Z and AA: Bähr 2016, 272.
27 The reader is referred to Gebhard/Krause 2016.
28 Gebhard/Krause 2016, 56 Fig. 18.
29 The original German quotations were translated into English for the international readership. As a rule, the English version follows the German version. In a few cases, the German or English sentence construction did not permit such an arrangement, since this would otherwise have impaired the reading flow. Here, the original German quotation was adapted to the English running text. The English translation is always set in italic script.
30 Fig. 1 after Bähr 2016, 267 Fig. 1. The suboval area indicates where Objects A (B10) and B (B11) and other items were found.
31 Gebhard/Krause 2016, 63.
32 Bähr 2016, 268.

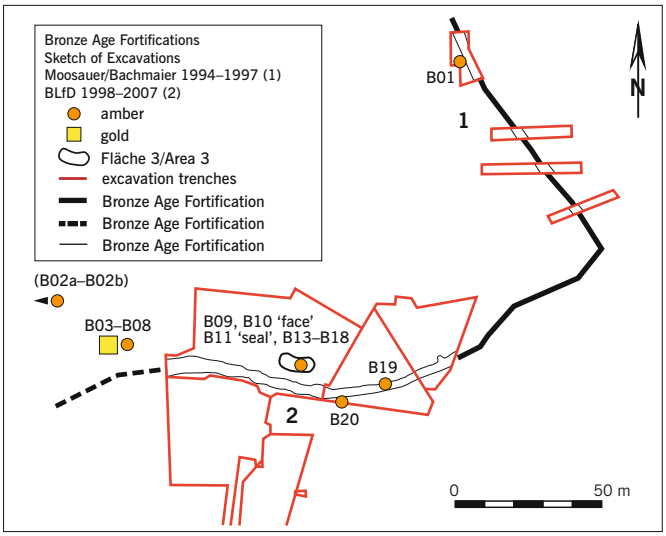

Fig. 1 Bernstorf, Freising district, Bavaria. Schematic plan showing the location of the amber and gold finds in relation to the Moosauer/Bachmaier (1994–1997) and BLfD (1998–2007) excavations.

these circumstances, the physical conditions for such a search were, as a matter of routine, extremely difficult and, in all cases, the determination of closed, stratigraphical contexts was impossible. It was neither possible to determine the original find deposition contexts nor whether finds found in proximity were originally from the same level/layer[33]. The finds themselves could have been deposited into the ground elsewhere on the site[34]. Today, an exact determination of their original (pre-discovery) positions is not possible.

56 pieces of amber were discovered over a period of nine years (May 1997–August 2005) (see Fig. 1 and Table 1). Of these, 37 small unworked pieces (B02a, B02b, B12) were found during the informal field survey either on the ground surface at a distance from the excavation areas or their find location is unknown (see below). Of the remainder, only three pieces of amber are reported from the excavations. One piece (B01) was excavated during Moosauer and Bachmaier's excavation in 1997[35]. The other two came to light during the BLfD excavations, one each in 2002 (B19) and 2005 (B20) respectively[36]. The 2002 example (B19) is the only amber find which could be tentatively associated with an archaeological feature, but even so it was discovered in a location interpreted as an erosion layer and not *in situ* in a primary context[37]. It is unworked. B01 and B20, both unworked, were also found in erosion layers and could not be directly associated with any archaeological features[38]. All the remaining 16 amber pieces (including the 'six amber objects' (B03–B08) and the two engraved items (B10–B11)) were also stray finds found within the tangle of root stocks[39]. All the amber finds, therefore, are acknowledged to be stray finds and/or from disturbed, secondary contexts[40]. There are no archaeological drawings or photographic

33 Bähr 2016, 270.
34 Gebhard/Krause 2016, 51.
35 Moosauer/Bachmaier 2005, 56–60; 56 Fig. 80.
36 Bähr 2016.
37 Gebhard/Krause 2016, 64; Bähr 2016, 272.
38 Bähr 2016, 268; 272.
39 Bähr 2016, 270; 267 Fig. 1; 271 Fig. 4.
40 Bähr 2016, 272.

records of the undisturbed find situation for any of the amber (or gold) finds[41]. None of these pieces, including those discovered within the area of the Bronze Age fortifications, can be directly dated or confidently assigned to any archaeological features.

Of the 56 amber pieces: six were found by the ASM (B04–B09); two were found in BLfD excavations (B19–B20); one was found in Moosauer/Bachmaier's 1997 excavation (B01) and the remaining 47 were found by Moosauer and/or Bachmaier working on their own. Whether other amber pieces were present at Bernstorf but not found must remain an open question[42].

5 Amber as a Material

Before considering the amber found at Bernstorf, it is useful to address some aspects of the material itself: how amber was formed; the use of scientific analyses to determine provenance; its natural taphonomy; colour and translucency; the effects of subjecting it to heat and methods of working. This is a necessarily brief and informal account of this wide-ranging subject[43].

'Amber' is the generic term for fossilised tree resins, which formed during several geological eras, and that commonly known as 'Baltic amber' is just one of many in the global record (Fig. 2)[44]. These resins were exuded by the so-called 'amber trees', whose species is the subject of debate. The most quoted candidate is *Pinus succinifera*, a tree not related to the modern *Pinus* species and now extinct[45]. These trees fell to the forest floor, were covered over and eventually buried at depth. Under these high temperature and high pressure conditions, the resins were transformed by a process of polymerisation into, initially, hard, brittle copals and finally into amber. The complete process encompasses millions of years. Its efficacy is dependent on several factors: pressure; temperature; water content; oxygen and the pH value of the enclosing soil matrix[46]. All stages of these same processes continue today.

The forms exhibited by raw pieces of amber are determined by the position in the tree where the resin was exuded (Fig. 3). Natural amber pieces can take the form of rounded or elongated droplets, flat plates, long 'icicles' or irregular shapes (Fig. 4). Their surface texture may be smooth; impressed with the pattern of the wood or bark against which it was pressed; wrinkled as it oozed from the tree and solidified in waves; puckered like the skin of an orange and other such patterning. Structurally, natural amber pieces range from solid and homogeneous to fractured and laminated or dented and grooved.

41 Rohde 2016, 275–306.

42 Moosauer reported that former workers from the gravel mining company had discovered »[...] zahlreiche und auch spektakuläre Funde [...], die weder gemeldet wurden, geschweige denn untersucht werden konnten.« *(... numerous and also spectacular finds which were neither reported, let alone examined.)*. According to Rohde (2016, 281 with footnote 57), the BLfD was unable to verify this statement.

43 There is an extensive literature concerning the physical characteristics, scientific analysis and archaeological contexts of amber. For a comprehensive collection of papers on all these topics the reader is referred in the first instance to: Ganzelewski/Slotta 1996. Bernstein 'Tränen der Götter' and Kosmowska-Ceranowicz/Paner 1999. Investigations into Amber. Proceedings of the International Interdisciplinary Symposium, Gdańsk, 1997.

44 Ganzelewski 1996a, 12–14; Krumbiegel/Krumbiegel 1996.

45 Ganzelewski 1996a, 12.

46 Pastorelli 2009, 4.

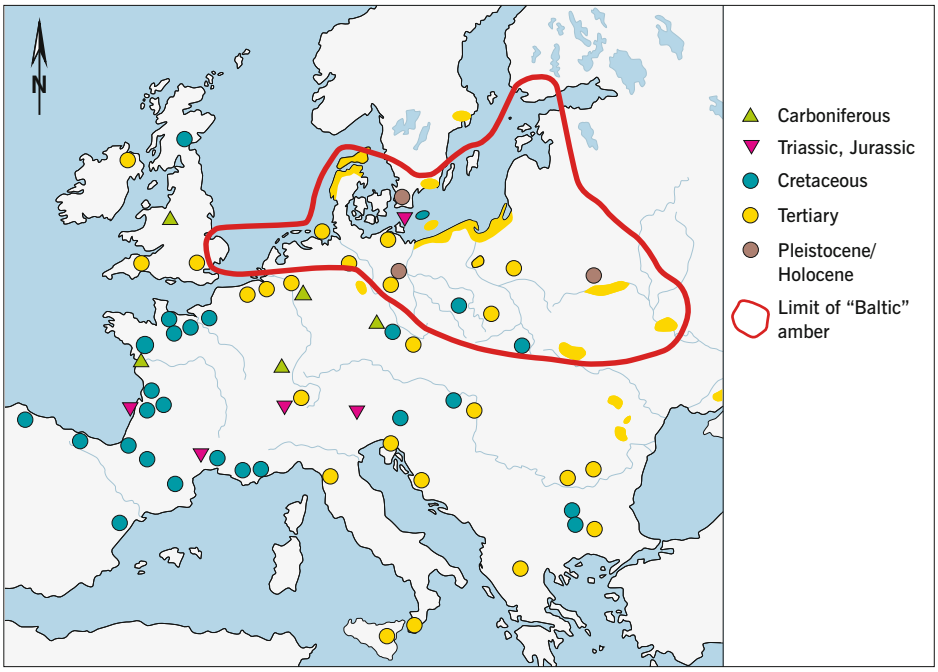

Fig. 2 Distribution of fossil resins in Europe and their geological periods.

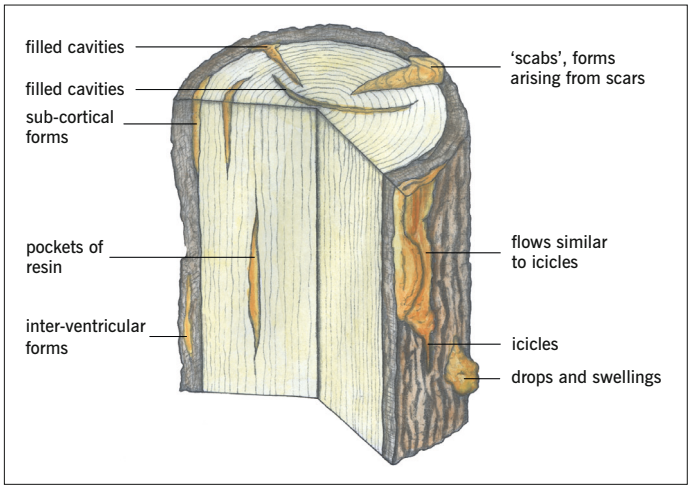

Fig. 3 Drawing showing locations within the tree where amber resins may be formed. These locations govern the natural form of the amber piece.

5.1 Scientific analyses of fossil resins to determine provenance

In archaeology, the discovery of amber in prehistoric contexts in southern Europe, principally Mycenaean Greece, led to theories about long-distance amber trade from the north, especially from the Baltic. What was lacking was a method of determining the source of the

Fig. 4a–d Gdańsk, Pomerania, Poland. Examples of Baltic amber showing various natural physical characteristics. *a* Translucency and colour of amber with progressively weathered crust; *b* Translucency and colours of amber caused by organic impurities, with crust removed and surface polishing; *c* Forms of amber dependant on location of formation within the tree (from left to right: shaped; plates; drops; icicles and irregular); *d* Structure of amber pieces (clockwise from top left: indented; laminated and solid). International Amber Association display, AMBERIF Amber Trade Fair, Gdańsk March 2008.

amber and, thus, whether such a north-south trade had actually occurred, or if the amber had instead come from more local sources (Fig. 2). Baltic amber is named 'succinite' as, during pyrolytic analysis, succinic acid is detectable. Its presence was used as a test for provenancing amber from the mid 19th century until the 1960s. From the 1960s, in pursuit of a more precise method of analysis, Curt Beck and colleagues employed infrared spectrometry (IRS)[47]. A comparative database of spectra was created from several hundred sources of raw amber and resins from across the world. While the non-European fossil resins showed a wide variety of overlapping spectra, it was possible to discern a discrete and distinctive absorption pattern ('fingerprint') for Baltic amber. This exhibited, in well-preserved samples, what has become known as the 'Baltic shoulder'. Using this method, Beck and others analysed numerous natural and archaeological amber samples from across Europe. More recently, pyrolysis gas chromatography (Py-GC) and pyrolysis gas chromatography mass spectrometry (Py-GCMS) has been used to differentiate between genuine and imitation amber in museum collections[48].

47 Beck 1966.
48 Shedrinsky et al. 1999. Christian-Heinrich Wunderlich (LDA) is preparing articles about the scientific analysis of amber which also appear in this volume.

This technique can also be used to distinguish Baltic from non-Baltic ambers. Research in the 1960s using samples from the Dutch coast and the Baltic suggested that it might be possible to distinguish between different Baltic samples[49], however, at the present time, this research appears not to have been replicated[50].

5.2 Natural taphonomy of amber

Although amber is several millions of years old and has already undergone extensive physical alteration, it remains an unstable material, vulnerable to degradation and even destruction by a range of natural processes[51]. The physical and chemical environment surrounding a piece of amber exerts a strong influence over the rate of its degradation (weathering). To devise neutral or, at least, minimally damaging environments to store amber under museum conditions, research has been conducted into the exact causes and pathways of this degradation[52]. The principal causes of degradation are the temperature and light conditions in which the amber is stored. High ambient temperatures and prolonged ultraviolet (UV) light exposure cause degeneration of the material, due to oxidation of the amber's terpenoid components. This contributes to the breakdown of chemical bonds and the creation of acids[53]. This degeneration is most apparent as an alteration to the surface of the material, forming into a weathered crust, and an alteration in colour to a progressively darker and redder hue. These processes begin at the surface and progress along existing fractures into the heart of the material. They gradually make their way through the whole body of the piece until, eventually, it consists solely of this weathered crust. Disintegration follows soon after. Unlike materials such as iron, the weathering of amber does not produce a dust or powder on the surface which can be brushed off to reveal the original surface beneath. In amber, it is the actual surface which is progressively physically altered, resulting in first a red - and in its final stages, cream-coloured and opaque crust. This weathered surface eventually cracks and can be removed or falls off, resulting in the complete loss of the original surface from the piece (Fig. 5).

In the natural environment, situations with an absence of light and low concentrations of oxygen inhibit these destructive processes. Such situations are usually marine-based or in soil environments which are permanently saturated/water-logged. Land-based deposits of amber, especially those which are close to the surface and/or are well-drained or aerated (such as sands or gravels), are exposed to conditions which are much drier and characterised by the increased presence of light and oxygen. Amber pieces lying in these conditions suffer far greater degradation, thicker crusting and a redder appearance than amber from (very much) deeper land-based or sub-marine environments where exposure to light and atmospheric oxygen is more limited[54]. A damp environment only retards the progress of this process, it does not halt it altogether. On excavation, archaeological amber from waterlogged, land-based deposits, is generally much less degraded than that from drier sandy or gravel deposits.

49 Poinar/Haverkamp 1985, 220.
50 Wolfe et al. 2016, 23.
51 Shashoua 2002; Pastorelli 2009.
52 Shashoua 2002; Pastorelli 2009.
53 Pastorelli 2009, 93.
54 Shashoua 2002, 1.

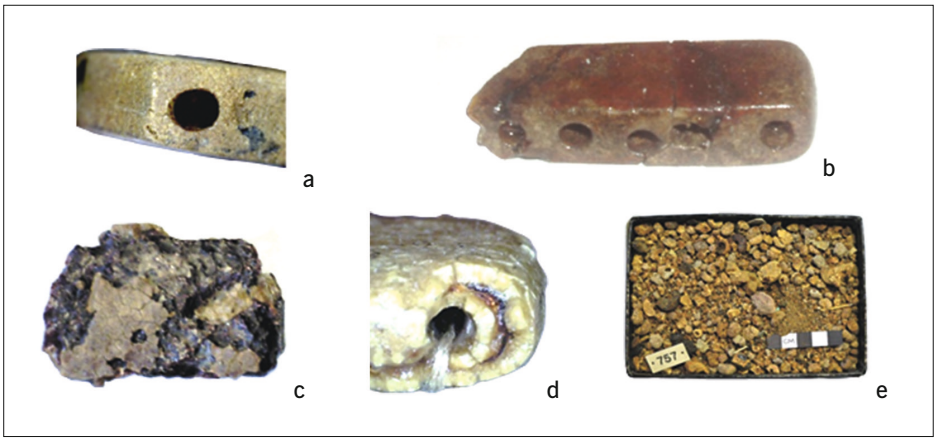

Fig. 5a–e Examples of differing taphonomic outcomes. top row: surface structure essentially intact and in good condition. *a* sharp edges; *b* integral surface and edges; bottom row: various degrees of weathering damage. *c* surface almost completely absent; *d* pale weathered surface and within perforation with a very thin layer of degraded amber between them; *e* amber essentially crumbled to small fragments and dust. The examples are all archaeological worked artefacts from Bronze Age sites in Britain and Europe. Not to scale.

5.3 Fluorescence in amber

Amber has a particular quality. Areas and surfaces which have been recently damaged, cut or polished fluoresce intensely blue under UV light. The more recent the episode, the stronger the fluorescence. Weathered amber does not fluoresce. Michael Ganzelewski describes the phenomenon in more detail[55]: „Frisch angeschliffene, unverwitterte Flächen leuchten intensiv blau, wenn sie von einer UV-Lampe (Wellenlänge 320 bis 380 nm) angeleuchtet werden. Nach einigen Monaten verblaßt die Intensität und der Bernstein zeigt unter UV-Licht nur noch ein mattes Olivgrün. Noch später zeigt der Bernstein überhaupt keine Floureszenz mehr. Bei älterem Bernstein, d. h. bei Stücken, die jahrelang dem Luftsauerstoff ausgesetzt gewesen waren, muß die dunkle Verwitterungsrinde entfernt werden, um die Floureszenz beobachten zu können." *(Freshly abraded, cut or polished[56], unweathered surfaces shine an intense blue when illuminated with a UV lamp (wavelength 320–380 nm). A few months later the intensity fades, and the amber shows only a dull olive green under UV light. Later still the amber no longer shows fluorescence. In older amber, that is with pieces that had been exposed for years to atmospheric oxygen, the dark weathering crust must be removed in order to be able to observe any fluorescence.)*. Weathered crust means no fluorescence.

5.4 Physical characteristics of amber

Amber is warm to the touch, has a pleasant odour on burning and is electrostatic. In the contemporary commercial arena, two of its most culturally valued characteristics are

55 Ganzelewski 1996b, 25.

56 'angeschliffene' can be translated as any of these English words.

Fig. 6a–b Examples of colour and translucent differences between the weathered surface and the interior of amber revealed when the surface is removed. *a* translucency revealed when crust removed; *b* opaque 'lemon-curd' coloured interior colouration. Pieces of raw Baltic amber from author's collection. 6b not to scale.

colour and translucency. In its natural state[57], these are related phenomena, governed by the presence of various inclusions and the weathered condition of the individual piece.

5.4.1 Colour

Unweathered amber ranges from almost colourless through pale yellow to white or dark grey (Fig. 4). Darker areas are a result of natural organic or mineral inclusions trapped within the sticky resin when it was exuded from the tree. A white colour is produced by the presence of minute air bubbles which refract light from their surface. As a result of exposure to various taphonomic processes (see below), the surface of amber becomes progressively redder. In natural examples, the deep red colouration which is highly valued in contemporary culture is seen only on heavily weathered material. This is only a surface phenomenon and removal of the surface crust can reveal the original colouration (Fig. 6), especially if the weathering process has not been of sufficient duration to affect the interior significantly.

5.4.2 Translucency

As a resinous substance, amber is completely translucent. Both inclusions and weathering reduce this quality. Air bubbles and minute fracturing within the structure of a piece refract light resulting in increased opacity (Fig. 4). Weathering produces an increasingly thick crust which becomes increasingly opaque over time. If the weathering process has not progressed completely through the body of the piece, removal of this crust can reveal its original translucency (Fig. 7). Both translucency and colour can be artificially manipulated and enhanced in the workshop.

57 I. e. not manipulated or dyed to make it more commercially attractive.

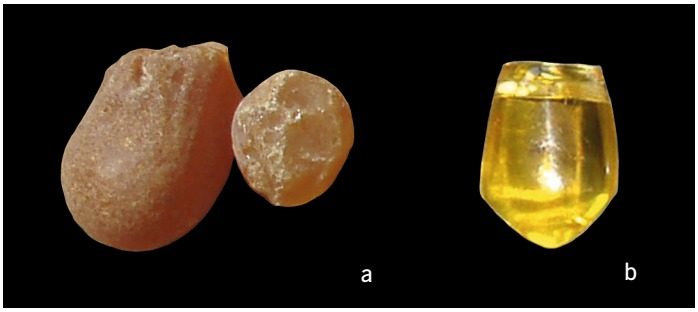

Fig. 7a–b An experimental example to show the difference in colour and translucency between a piece of naturally weathered raw Baltic amber and the bead produced from it. *a* naturally formed droplet of amber (on left); *b* the bead made from it by the author, shortly after manufacture. Not to scale.

5.4.3 The effects of heat on amber

When amber is heated, it does not melt to a viscous liquid, but rather begins to progressively decompose and, if the temperature is high enough, burns away very intensely with a bright yellow flame and a strong flag of black soot[58], releasing a distinct resinous aroma, like incense[59]. Amber varnishes are made by heating amber pieces with turpentine or other oils, which provide the liquid component[60]. When amber is heated, either in oil or with a dry heat, and then cooled, characteristic disc-like stress fractures, 'sun-spangles', form at weak spots throughout the body of the amber (Fig. 8b)[61]. Heating a freshly exposed/broken surface results in an increasingly dark and lustrous surface (Fig. 8a), while heating a weathered surface results in an increasingly black and rough crust (Fig. 8b).

5.5 Working with amber

Amber can be readily worked. It lies between 2.5 and 3 on the Mohs scale, making it harder than gypsum but softer than calcite. Weathering generally increases the hardness of the surface[62]. Its resinous constituency allows it to be polished to a high lustre. While doing research for an M. A. in experimental archaeology[63], the author specialised in the working of amber. A few of the results of that practical research are shown here as they provide an opportunity to see photographs both of small pieces of amber as it can be bought in the current commercial markets and examples of what amber looks like immediately after it has been worked in a variety of ways[64]. The four examples presented here were chosen because of their relevance to the amber from Bernstorf. In another context, the lead authors of the 2016 Bernstorf volume call this type of research,

58 Feist et al. 2007, 167–168.
59 Ganzelewksi 1996b, 25.
60 Ganzelewski 1996c, 234.
61 Craddock 2009, 436. Some Bronze Age amber artefacts exhibit these 'sun-spangles'. For an example, see Berger/Classen 2012, 58 Fig. 10.
62 Ploug 2000, 20.
63 University of Exeter 2007–2009. Gebhard and Krause (2016, 124) suggest that the present author's only experience of amber is with heavily weathered pieces which have been stored for years in museums under inadequate environmental conditions, but this is incorrect.
64 What might be termed 'factory-fresh'. These experimental results are shown informally for general understanding.

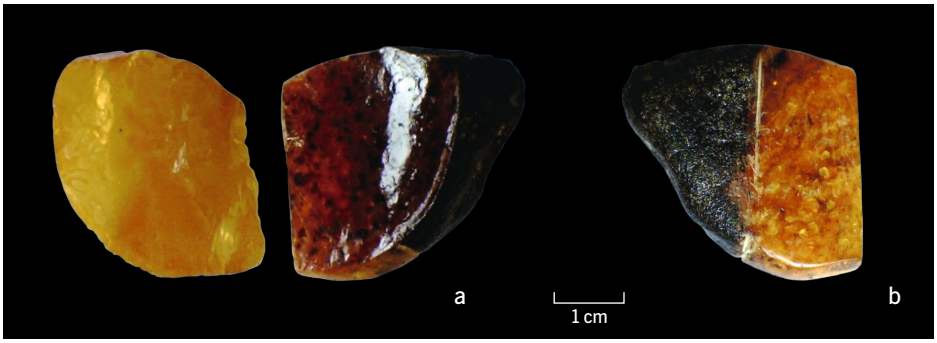

Fig. 8a–b Experimental piece to show the effects of heat on amber. *a* raw amber block split into two, showing the interior, conjoining surfaces: left hand piece unheated. Its reflective surface is natural on breakage and is not polished; right-hand piece heated in a dry oven for one hour at 200 °C. The surface has darkened and has developed a high sheen (unpolished); *b* the outer weathered surface of the heated section. The surface has developed a dark, rough crust. This has been partially removed to reveal the 'sun-spangles' (small disc-like fractures) in the interior.

'kitchen experiment'[65] and by virtue of this unflattering description, question its relevance to serious archaeological investigations. It is important to recognise, however, that the author does not claim in any way that these examples replicate the tools and techniques used to work the amber from Bernstorf. They are presented with the intention to better acquaint the reader with some of the processes of working amber and the results that can be achieved with 'simple', non-machine tools. Gebhard has already established that metal tools were used to work the Bernstorf amber and specifically ruled out the use of flint[66].

Obtaining genuine amber today is problematic as there are many items claiming to be genuine amber pieces which are actually made from compressed amber powder, other natural materials of similar appearance, or components such as plastics and synthetic resins[67]. Amber is sold principally by weight, with aesthetically pleasing and/or large pieces attracting an added premium. Most dealers remove much of the weathered crust, and polish or otherwise enhance their amber stock to attract a better price. As customers for amber want to use it for so many different purposes, it is possible to find amber in whatever condition or form desired[68]. Figure 9 shows that it is possible to find natural pieces with shapes which closely mirror the form of the desired finished product, in this case, a naturally 'seal'-shaped piece. Figure 10 records the process of cutting a groove around an amber drop to produce a protuberance. Working with amber produces an amber dust which covers the craftsperson's hands. It is inadvertently introduced into, and visually enhances (compare Fig. 10a.c) any natural crazing on the surface of the piece. Figure 11 deals with drilling a conical perforation into an amber droplet, using a tapered flint drill-

65 Gebhard/Krause 2016, 20. Previously, Gebhard was the director of the restoration workshops at the ASM (Rohde 2016, 280).

66 Gebhard/Rieder 2002, 122.

67 The International Amber Association is the trade body attempting to protect customers from unscrupulous dealers, <http://www.amber.org.pl> (10.02.2017).

68 See the Amber Workshop's website for the range and current price of amber on sale, <http://www.amberworkshop.com/raw_amber_materials.htm> (20.02.2017).

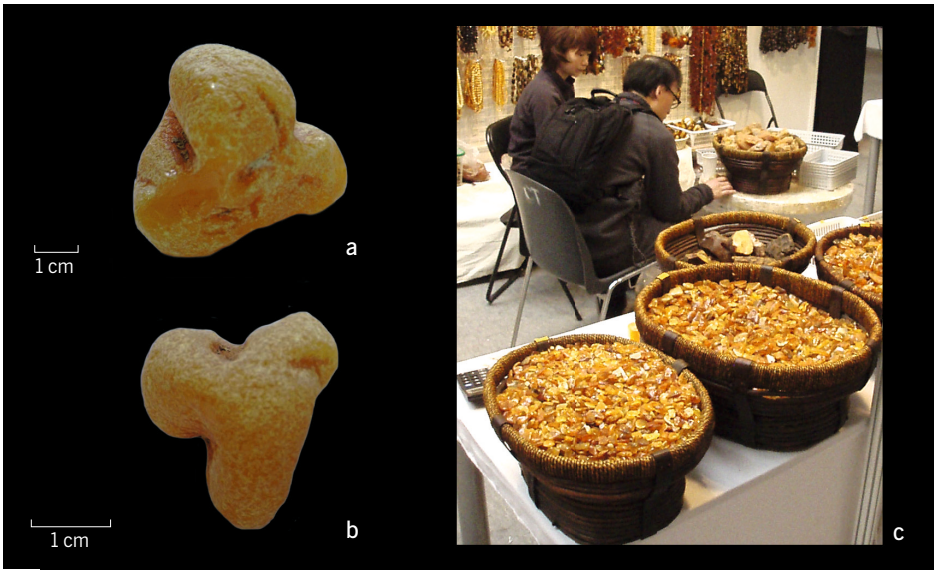

Fig. 9a–c Small pieces of amber. *a–b* Naturally 'seal'-shaped piece of raw Baltic amber bought by the author at the Amber Trade Fair AMBERIF 2008; *c* one of the many stalls at AMBERIF 2008, with basketsful of small pieces from which to make a choice.

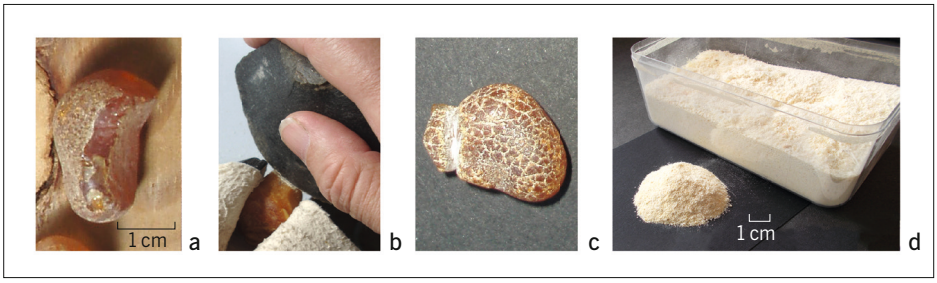

Fig. 10a–d Groove cut experimentally to isolate a protrusion on a raw amber droplet. *a* original condition of the piece; *b* cutting with a flint blade; *c* the completed cut. Note how the crazing on the surface has been visually enhanced due to the inadvertent application (from the craftsperson's hands) of the amber dust created during the cutting process; *d* one of the boxes of amber dust produced during the author's craft-working with amber. 10b-c not to scale.

bit. Here the perforation was drilled from both sides to meet in the middle. This reduces the risk of break-out damage when the drill-bit suddenly exits the far side of the perforation, but does not prevent damage caused by the pressure of the rotational torque of the drill-bit at the entrance point. In amber, such damage can easily and unexpectedly occur and is related to the surface structure of the amber at that point and/or possible sideways 'wobble' of the drill. In Figure 11d, the interior of the conical perforation with the rilling marks left by the drill-bit can be seen as well as the much smaller hole connecting the two ends of the perforation. Enlarging the diameter of the hole at the connecting point is possible by continuing to drill, but if there are any unseen fractures within the body of

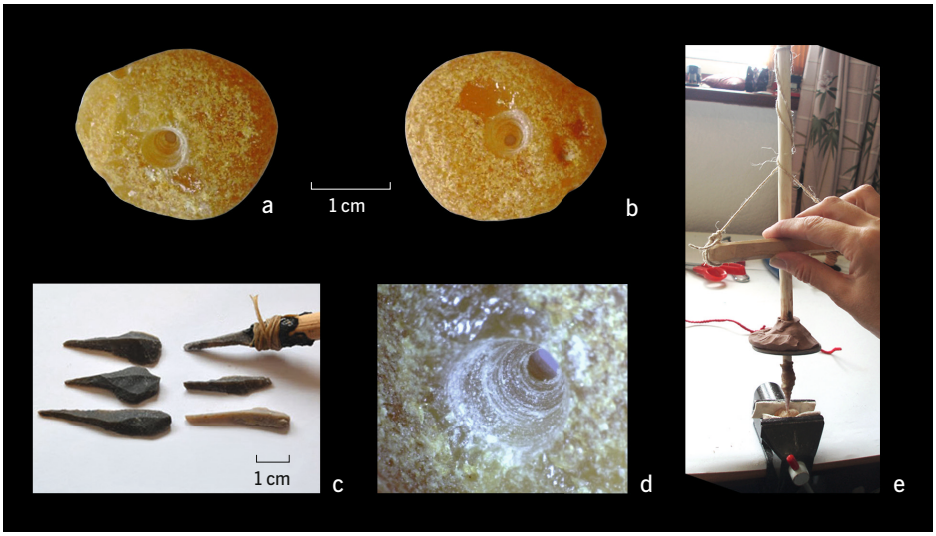

Fig. 11a–e Experimental drilling of raw amber with a tapered flint drill-bit. Perforation drilled from both sides. *a–b* both entrances to perforation. Note damage to the weathered surface at the edge of the hole; *c* tapered flint drill-bits before drilling; *d* close-up of conical perforation showing rilling inside still containing some amber dust from the process; *e* the author using a pump drill with flint drill-bit. 11d–e not to scale.

the piece which weaken its integrity as a whole, especially in the region of the hole, there is a risk that the piece could fracture as the rotating drill-bit removes material from an increasingly thin, and thus fragile area. The last example (Fig. 12) shows that it is possible to drill perforations with straight-sided and sharp edges using flint or bone as well as with different types of metal[69]. The consequences of these examples on the interpretation of the Bernstorf amber as being of ancient production are addressed in the examination of production traces on the Bernstorf amber in the discussion below. The next section addresses the amber found at Bernstorf between 1997 and 2005.

6 The Bernstorf Finds

There are 56 pieces of amber recorded as being found at Bernstorf[70]. These can be divided into four categories, which will be addressed separately below.

1 small, unworked pieces (B02a, B02b, B12);
2 other unworked pieces (B01, B09, B13, B14–B20);
3 the 'six amber objects' (B03–B08), each with a single perforation;
4 the engraved objects ('face' B10, 'seal' B11). See Table 1 and the catalogue entries for more details on each piece. See Figure 1 for the location of find spots at Bernstorf.

69 The bone and copper drill-bits were made by the author. The other drill-bits were made especially for the author by: *a* flint - Prof. Bruce Bradley, experimental archaeologist and master flint-knapper, <http://humanities.exeter.ac.uk/archaeology/staff/bradley/> (15.02.2017); *b* 12 % tin-bronze – Neil Burridge, a bronze smith who specialises in replicas of archaeological artefacts, materials and processes, <http://www.bronze-age-craft.com/> (15.02.2017).

70 Gebhard/Krause 2016, 138.

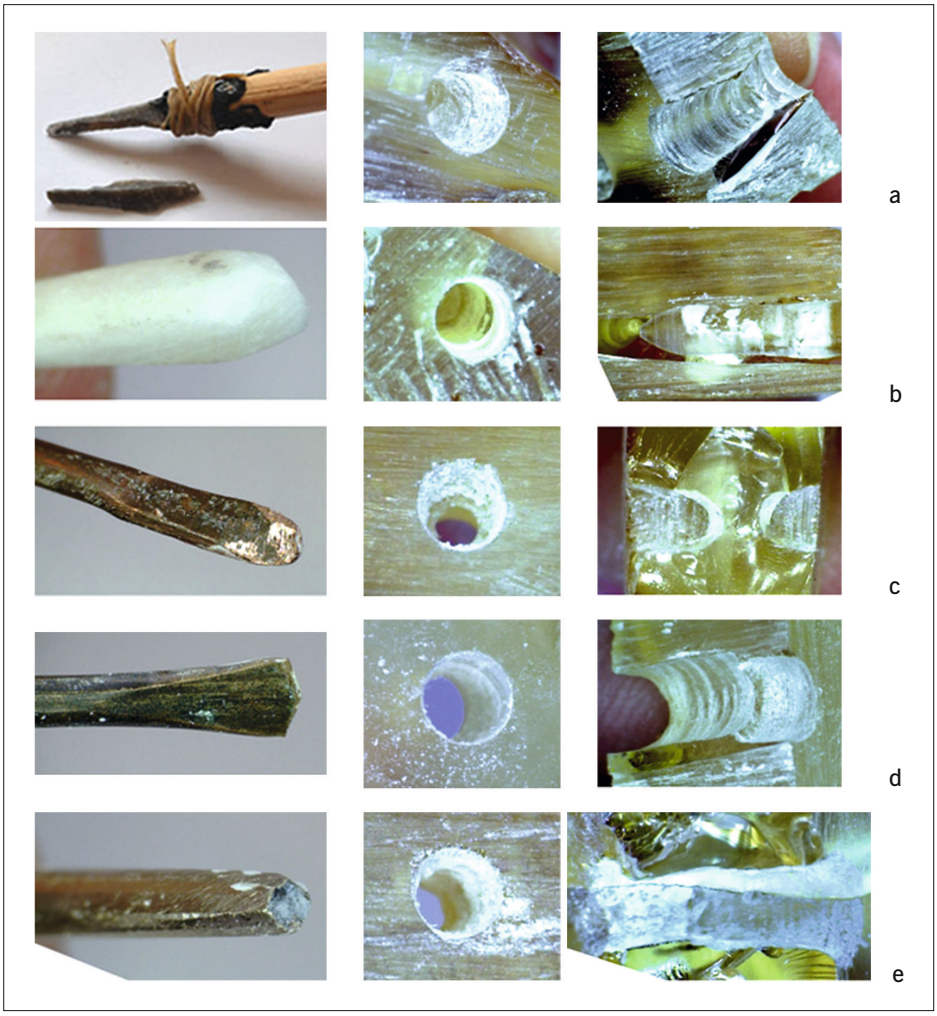

Fig. 12a–e Experimental drilling of raw amber. Examples of drill-bits of different materials. *Left* the drill-bits after the process; *centre* the perforations created; *right* the rilling in the perforation (cut open to expose the interior). *a* straight-sided flint drill-bit; *b* bone drill-bit; *c* copper drill-bit. Note that the perforation was not completed as the soft copper drill-bit became too deformed to continue; *d* 12 % tin-bronze drill-bit with round-profile shaft/spade-head tip; *e* 12 % tin-bronze drill-bit with square-profile shaft. Score-lines on the body of the amber are the result of sawing the block in half along the perforation with a fine-toothed metal-hacksaw. Not to scale.

6.1 The small, unworked pieces of amber (B02a, B02b, B12)

All 37 of the small, unworked pieces which make up these three catalogue entries were collected by Bachmaier during informal field survey at Bernstorf. B02a (five pieces) and B02b (26 pieces) were found some distance away from the area of archaeological investigations (Fig. 1), which Bähr[71] suggests was about 350 metres to the west of the gold finds.

No more specific information is available. The location of the discovery of B12 (six pieces) is completely unknown[72]. Apart from the piece of amber (B01)[73], the 31 small, unworked pieces deposited in July 1998 with the ASM by Bachmaier (B02a and B02b) were the first amber pieces formally reported from Bernstorf. The finds entries/labels for B02a, B02b and B12 state simply that these are 'Lesefunde' *(stray finds)* together with only the month of discovery, suggesting that the individual items in each of the groups may have been collected as a result of more than one episode of activity. Owing to the nature of the field survey activities, it seems very likely that these were found on the ground surface. As the circumstances/location of these finds are not recorded in detail, it is not clear whether this was the modern ground surface or a surface which had been scraped clear by earth-moving equipment prior to gravel extraction. If it was the modern ground surface, then the suggestion of a prehistoric origin seems highly dubious as the amber could conceivably have been accidentally lost by a recent visitor. The area around Bernstorf is a popular recreation and leisure area with many visitors daily using the permanent paths alongside the canal and Amper river, the various lakes, and the forest tracks which cross the Bernstorf hill[74]. If these items were found instead on a surface scraped clear by machine, then it seems incredible that there was no damage, not even any superficial abrasion to any of the 26 small pieces in B02b. This is attested to by the fact that none of them fluoresced under UV light, which they would have done if they had been damaged. Earth-moving equipment is not noted for a light and delicate approach and most likely traversed the cleared area several times to accomplish its task. If this was indeed the location in which these amber pieces were found, it seems to the author unlikely that such fragile pieces would have escaped being crushed but instead exhibit no damage at all.

The five pieces of amber from B02a were not tested under UV light, but do not appear to have suffered any visible damage (Fig. 27). The six pieces of amber from B12 showed a slight fluorescence[75] but otherwise also do not appear to have suffered any visible damage (Fig. 41). The only reason that these small, unworked and undamaged pieces have been discussed in connection with the other amber from Bernstorf is that they were handed in to the ASM by Bachmaier, albeit with little accompanying detail. The author does not believe that any of these 37 pieces should be considered as part of the Bernstorf amber assemblage, and thus should be disregarded from any future discussion and interpretations.

6.2 The other unworked amber (B01, B09, B13–B20)

Discounting those pieces just mentioned above, there are 10 pieces of unworked amber discovered at Bernstorf. Three of these pieces were found during formal excavation campaigns: B01 in 1997 at Moosauer and Bachmaier's excavation; B19 in the 2002 BLfD exca-

71 Bähr 2016, 267 Fig. 1, inset box.

72 Bähr 2016, 271. They were deposited together at the ASM, but whether they were found as a group or individually is also unknown.

73 Not reported to the BLfD until April 1998 despite having been discovered in Moosauer/Bachmaier's excavation in May 1997, see below.

74 The author walked all around and onto the Bernstorf hill in October 2014.

75 Gebhard 2002, 127.

vation, and B20 in the 2005 BLfD excavation. All of the remaining items were found by Moosauer and/or Bachmaier in Area 3 (see Table 1 and Fig. 1).

B01

This piece of amber is reported as being found within the eastern side of the Bronze Age fortification, about 1 metre below the present ground surface[76]. The depth below the surface is explained by Bähr as the result of the find being made in a natural hollow filled with erosion material. Other finds in the general area include ceramics and flint[77]. It was originally suggested that the amber was discovered inside a broken ceramic vessel and associated in some way with what the excavators described as a cult-post[78]. Bähr states, however: »Eine Verbindung mit dem sog. Kultpfahl, [...], ließ sich nicht nachweisen.« *(There is no evidence of any connection with the so-called cult-post.)*[79]. No-one mentions the ceramic vessel anymore. There was also a suggestion that this piece of amber had been perforated[80], but the present author's examination showed this to be a natural depression and the piece to be unworked. B01 is a naturally-shaped piece of amber with one side exhibiting a minimally weathered surface and the other side composed of a mass of fractures, all completely unweathered (Fig. 13; 26). Bähr reported that some of the fractured pieces had fallen off subsequently and had been glued back into place[81]. It might be assumed that this freshly broken surface must have been caused during the excavation itself, but if that were the case then the remainder of the piece would have been recoverable at the time. The piece was reportedly discovered „in einer hellen Sandschicht [...]" *([lying] in a light [coloured] sand layer ...)*[82]. The exposed and heavily fractured internal surfaces are completely unweathered and (like the remainder of the surface) have a light orange colour. In the author's opinion, these characteristics are incompatible with this piece having lain in a highly acidic sand layer[83] for any length of time.

Although the date on the fair copy of the finds sheet is listed as 27.05.1997, there appears to be no mention of its discovery in the excavation notebooks kept by Bachmaier[84], archived at the ASM[85]. At that time, the main excavation records were a series of 3,000+ colour photographs, but there is no photograph of the amber *in situ* or otherwise[86]. This is surprising as Moosauer and Bachmaier make a great deal of this piece of amber in their 2005 publication, but there appears to be no mention of it at all until a letter from Moosauer to Stefan Winghart dated 15.04.1998 and the partial delivery of the collated site records (rewritten in fine copy rather than the actual record sheets/day books written at the time of discovery) to the BLfD in April 1998[87].

76 Bähr 2016, 268.
77 See Moosauer/Bachmaier 2005 for photographs of these finds.
78 Moosauer/Bachmaier 2005, 56–57.
79 Bähr 2016, 268.
80 Moosauer/Bachmaier 2005, 56–57.
81 Bähr pers. comm. October 2014.
82 Bähr 2016, 268.
83 Röpke (2016, 233) reports the sand/gravels at Bernstorf have a pH value which shows strong acidity.
84 Bachmaier kept three notebooks on her archaeological activities, one of which was exclusively devoted to the excavation records at Bernstorf. These notebooks are in Bachmaier's private archive with copies and transcripts at the ASM. Parts of the excavation diary is written in typist's shorthand. Gebhard/Krause 2016, 55.
85 Gebhard/Krause 2016, 55.
86 Rohde 2016, 287 Tab. 1.
87 Rohde 2016, 281 with footnote 58.
88 Gebhard/Rieder 2002, 127.

Fig. 13a–b Bernstorf, Freising district, Bavaria. Unworked piece of amber B01. *a* side view; *b* end view. Note the mass of fresh, unweathered fractures on this side of the piece. Not to scale.

Fig. 14 Bernstorf, Freising district, Bavaria. Unworked piece of amber B09. Area of burning overlying the unweathered surface. Not to scale.

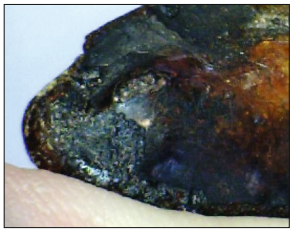

Fig. 15 Bernstorf, Freising district, Bavaria. Unworked piece of amber B13. Area of burning overlying the unweathered surface. Not to scale.

B09

B09 is completely unweathered on both the external surface and the two broken, conjoined surfaces. The damage may have been caused by earth-moving machinery which heaped up Area 3. There is an area of burning which overlies one of the unweathered surfaces (Fig. 14; 34b–c). In 2002, this piece of amber was tested under ultraviolet light with the result: „Es weist eine frische Beschädigung auf, die stark fluoresziert. Die unbeschädigte, glatte Oberfläche weist leichte Fluoreszenzerscheinungen auf [2.1.2001]."*(There is fresh damage which fluoresces strongly, while the undamaged, smooth surface fluoresces slightly [2.1.2001].)*[88].

B13

B13 has medium weathering over most of its surface. However, there is a section where the surface is completely unweathered, perhaps due to breakage of some kind. There is burning on both the weathered end and on this unweathered surface (Fig. 15; 42c.e – left hand end). This combination is difficult to explain unless the burning is from a much more recent event.

B14–B18 (Fig. 43–47)

B14 and B15 are small, naturally amorphous pieces of amber, with fully weathered surfaces, (dark in places) and no distinguishing features. B16, B17 and B18 are larger natural pieces with fully weathered surfaces. They are less weathered than B14–B15 and less amorphous. None of these pieces have any distinguishing features.

B19

This is a naturally-shaped, angular piece of amber with only medium-light weathering on the surface. The 'wrinkles' in its surface (Fig. 48a) were formed when the resin was exuded and solidified in waves. It was found in a wheelbarrow-load of material removed from „Befund 1320" *(Context 1320)*, which was described „[...] als zum Teil sandig, hart und krustenartig verziegelte Schicht aus dem Kernbereich der Brandzone der Holz-Erde-Mauer [...]." *(... as a partly sandy, hard and crusty burnt layer, from the core of the fire zone of the earth and timber wall ...)*[89]. It is otherwise unremarkable in character. The noteworthy thing about this piece is that it is the only amber from Bernstorf which might be associated with an archaeological feature. It was, however, not found *in situ*[90].

B20

This is a naturally-shaped piece of amber with rounded edges and only medium-light weathering on the surface. It was found „[...] südlich der Mauerschuttschicht, d. h. außerhalb der bronzezeitlichen Befestigung. Er war eingebettet in eine gelbe, kompakte Schicht aus schluffigem Sand, ... [die] als Erosionsschicht gedeutet [wird]." *(... south of the wall debris layer, i. e. outside the Bronze Age fortification. It was embedded in a yellow, compact layer of silty sand... which is interpreted as an erosion layer)*[91]. The circumstances of its discovery are disputed[92]. It is otherwise an unremarkable piece.

6.3 The 'six amber objects' (B03–B08)

Six of the pieces of amber are routinely discussed together, implying that they were originally (i. e. in the Bronze Age) an integrated set. One of them (B03) was found by Moosauer and Bachmaier[93] seven months prior to the other five amber pieces (B04–B08) being found by the ASM (see Table 1 below). Gebhard[94] shows the findspot for B03 as being around 1 metre distant from the area of the gold finds and about the same distance from the other five pieces. Apart from the 'face' (B10) and the 'seal' (B11), these are the only worked pieces from the site. Although they originally had ASM find accession numbers related to the different years in which they were discovered, in 2002 these six pieces were renumbered so that all have the same denomination '2002 (a–f)'. This action fur-

89 Rohde 2016, 285.
90 Gebhard/Krause 2016, 64.
91 Bähr 2016, 272; 272–273 Tab. 1.
92 Gebhard/Krause 2016, 64; Rohde 2016, 285 with footnote 103; 286; 287 Tab. 1.
93 Gebhard/Krause 2016, 59.
94 Gebhard 1999b, 2 Fig. 1.

ther reinforced the suggestion that they were originally in association with each other[95]. All these six pieces of amber show traces of burning to a greater or lesser degree (Fig. 28–33). Most have burning at discrete locations, usually at one end and/or along one edge. The very localised nature of the burning is consistent with the piece being held for a short time in a naked flame.

B03 has a long, narrow, sharp-edged cut along one side. There is no weathering inside this cut and the burnt area stops at its edge (Fig. 33f). To the author this seems unlikely to be a natural feature, but is otherwise unexplained. All of these six amber objects are perforated (Fig. 16). Except for the cut on the side of B03, there is no evidence of other working on any of the pieces. Again except for B03, the perforations are all parallel-sided, i.e. not conically shaped as has been suggested. In some cases the entrances and exits of the perforations have damage which may have led some observers to suggest that the perforations are conical[96]. In B04, B07 and B08, this damage is unweathered. This is especially clear in B08, where the circular scars seen in the damaged area are reminiscent of the type of damage produced by a rotational torque, for instance, by a drill. With B03, the perforation is in two parts. The innermost perforation is parallel-sided, but at the entrance on the upper surface, an additional drilling has been made which widens the hole. There is break-out damage at the exit showing that the perforation was drilled from one side only. The perforations themselves show different degrees of internal weathering. B03, B04, and B08 appear to be almost completely unweathered, although they retain some compressed dust from the drilling process itself. In contrast, B05 and B06 are weathered to the same degree as their surfaces.

All of these 'six amber objects' were tested for fluorescence[97]. The results were reportedly the same for them all. Their surfaces were found to have a partial, weak fluorescence. Around the perforations, there was distinct fluorescence detected. This is perfectly in keeping with the damage around the perforations. Just why there should be damage so localised around the perforations while there is no other damage to the piece is unexplained.

The fact that there are traces of burning on all these pieces and that a few of them have small sections of straight edges led to the suggestion that the edges of all these pieces had been worked originally to produce approximately rectangular forms, which had since been damaged by fire[98]. This is not the case. With the possible exception of B08, all these pieces have shapes and edges which are perfectly consistent with naturally occurring forms. B08 has a curious flat and beaked form which may have been artificially produced, although strange shapes do occur naturally as well. In the 2016 volume, the lead authors have now revised their interpretation and agree that these are naturally-shaped pieces, although they still suggest: „Ob die geraden Kanten von einer Bearbeitung stammen, lässt sich nach den Erhaltungsbedingungen nicht sicher entscheiden." *(Whether the straight sides are derived from manufacturing processes cannot be reliably determined due to the conditions of preservation)*[99]. The present author does not believe that these naturally-shaped pieces have been worked in any way, except for the perforations.

Gebhard's original idea behind suggesting an original (*sensu* 'manufactured') rectangular form for these pieces may rest with the sets of rectangular amber spacer beads

95 Bähr 2016, 268.
96 Gebhard/Krause 2016, 70.
97 Gebhard/Rieder 2002, 127.
98 Gebhard 1999b, 8.
99 Gebhard/Krause 2016, 71.

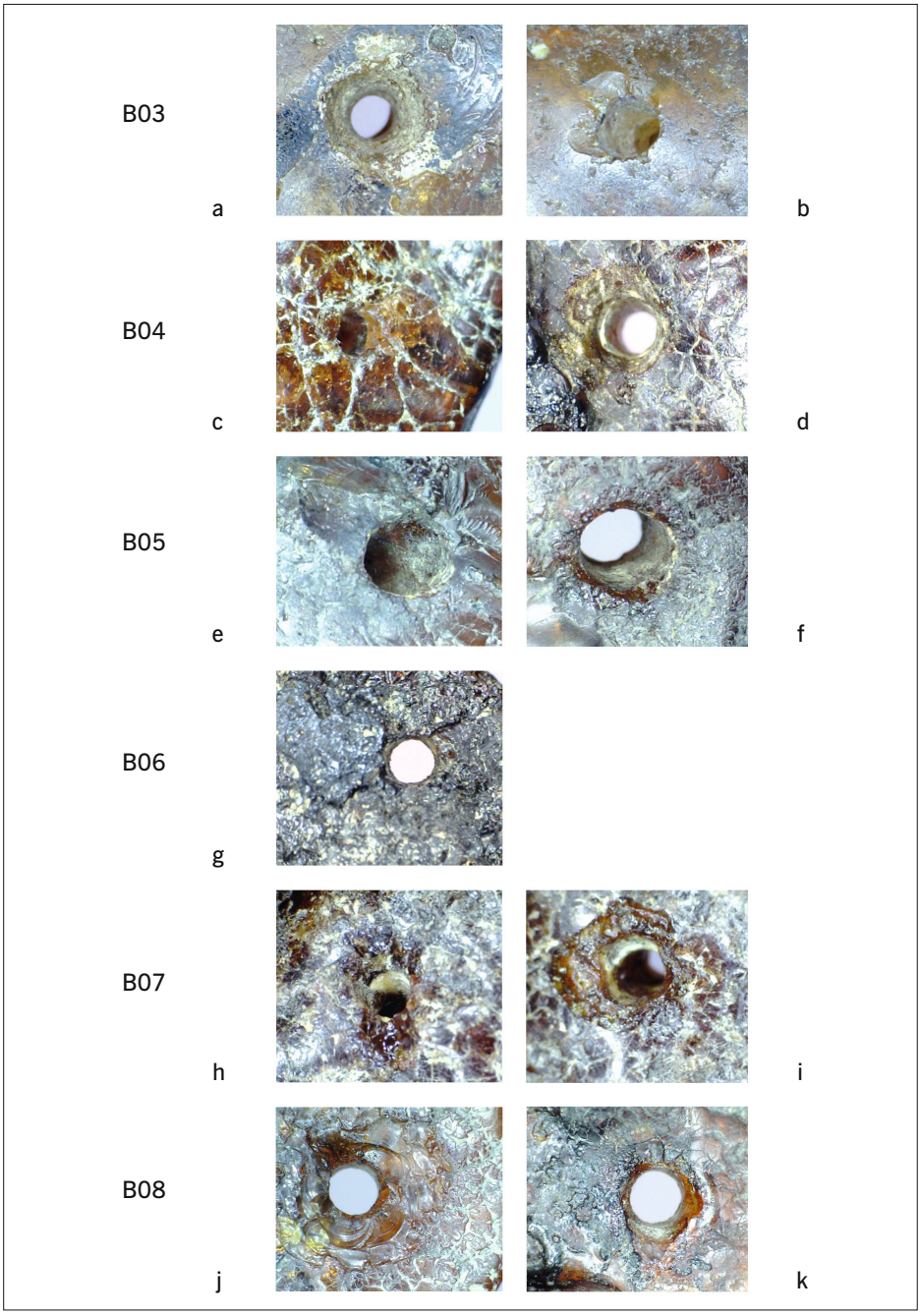

Fig. 16a–k Bernstorf, Freising district, Bavaria. Perforated amber objects B03–B08. Close up details showing the entrances and exits of the perforations in all of the 'six amber objects'. Note the fresh, unweathered damage at the entrances seen in *d, h–k* which has led to the impression that these are conical perforations. Not to scale.

which appear in the Bronze Age across Europe. These sets of amber spacers are well known in Bronze Age research[100]. As similar amber spacers were found by Heinrich Schliemann in the Shaft Graves at Mycenae, these artefacts have become connected with theories of direct trade links between northern Europe and Mycenaean Greece. A particularly fine example of a set of these amber spacers was found at Asenkofen, Freising district, in 1904[101], some 18 km east of Bernstorf. These spacers were referenced alongside the discussion about the 'six amber objects' from Bernstorf. The implication derived from the comparison was that the Bernstorf pieces may originally have been such a set of spacers and thus linked to this and other (supposed) examples of direct trade with Mycenae which have been found in the general Bernstorf region.

6.4 The 'face' (B10)

This engraved piece of amber, the 'face', was discovered by Moosauer and Bachmaier while searching Area 3, an earth/root mound approximately 50 metres east of the gold finds (Fig. 1, Table 1). It was not encased in a clay/sediment envelope[102], although Moosauer had originally suggested this and noted »Es schaute aus einer Ummantelung aus Lehm heraus, wie wir sie schon von den Goldblechen kannten!« *(It was peeping out from a covering of clay, such as we were already familiar with from the gold pieces!)*[103]. Any adhering soil was removed by the finders and the 'face' (B10) was delivered to the ASM in a clean state.

This item is roughly triangular, although only one edge is actually straight. From the perspective of the face, the triangle is inverted, with the lower point at the chin. The straight line at the top of the piece corresponds to the top of the head. The front side (with the 'face') is reasonably flat, curving away only at the sides. The rear side (with the three symbols, identified as 'Linear B' characters)[104] is more uneven. Throughout the central section, onto which the characters are engraved, the surface bulges in places. There is a deep, weathered scar near the lower point of the triangle. Across the top there is a low area which appears to be the result of an old break. The surface of this break is uneven, but quite smooth and is different to the rest of the item's surface, which has formed a more heavily weathered crust.

The engravings and the weathering must be considered together. Looking at the position of the engravings relative to the surface, it is clear that the 'face' and the characters were all engraved into an *already* weathered surface. They were not engraved onto a clean, fresh surface which has subsequently weathered. This is shown by the engraved lines which cut through the weathering and into the unweathered material beneath, leaving pieces of weathered surface which stand proud of the engraved lines. This is especially clear on the rear side (Fig. 17), where the engraved characters on the left and right-hand sides run across from the weathered surface to the smooth surface with no break in the quality of the line or the amount of weathering inside the groove (Fig. 18). The central character sits wholly on top of the weathered surface, with its upper edge just at the border of the two surfaces. It is clear

100 The amber spacers were the subject of the author's PhD dissertation (Verkooijen forthcoming).
101 Wenzl 1907.
102 Bähr 2016, 270; 271 with footnote 27.
103 Moosauer/Bachmaier 2005, 104.
104 Gebhard/Krause 2016, 51.

Fig. 17 Bernstorf, Freising district, Bavaria. Amber 'face' B10. The 'square' symbol on the rear of this piece has been cut through the already weathered surface, leaving raised areas of weathered surface surrounded by the unweathered engraved lines. Not to scale.

that when this piece of amber was selected for use, the weathered surfaces as they are now seen were already in place. This means that a small, previously broken, uneven and, on most surfaces, heavily weathered piece was selected to be made (without any modification to improve the surface) into what is now interpreted as an important item, possibly part of the equipment of a cult image. The iconography of the 'face' in relation to Mycenaean anthropomorphic images is discussed by the lead authors of the 2016 Bernstorf volume[105]. The scratch lines from the tool which made the engravings can be seen inside all the grooves, except where they exhibit a clear, smooth, glossy varnish-like surface. This glossy varnish-like surface is only present at the base of the engraved lines and can be seen in the lines for the upper part of the face (i. e. excluding the beard) (Fig. 19). This varnish-like surface cannot be the result of melting due to heat, as it is completely clean and clear[106] and there is no trace of burning close to the grooves, apart from the central character on the rear (Fig. 18). There the pattern of burn marks is positioned discretely on the *inside* of the engraved line of the top-left quadrant of the 'wheel-shaped' symbol, but not on the surface nor in the outline of the 'wheel' itself. There are also very localised

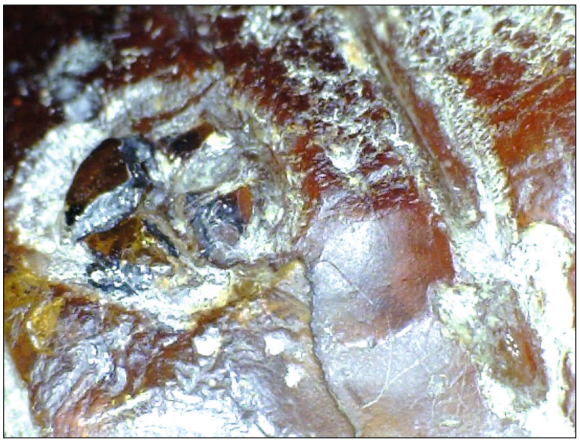

Fig. 18 Bernstorf, Freising district, Bavaria. Amber 'face' B10. The engraving of a 'spear-shaped' symbol (right, head pointing down) runs straight across from the weathered to the smooth surface with no change of quality inside the engraving. Note also the pattern of burn marks on the *inside* of the engraved line of the top left quadrant crossing the 'wheel-shaped' symbol, but not its surface nor in the outline of the 'wheel' itself. There are also very localised burnt areas in the bottom two quadrants. Not to scale.

105 Gebhard/Krause 2016, 129.

106 If the result of heat, it would be expected to be a dark colour. The author can offer no explanation for what this varnish is or how it came to be in the engraved lines.

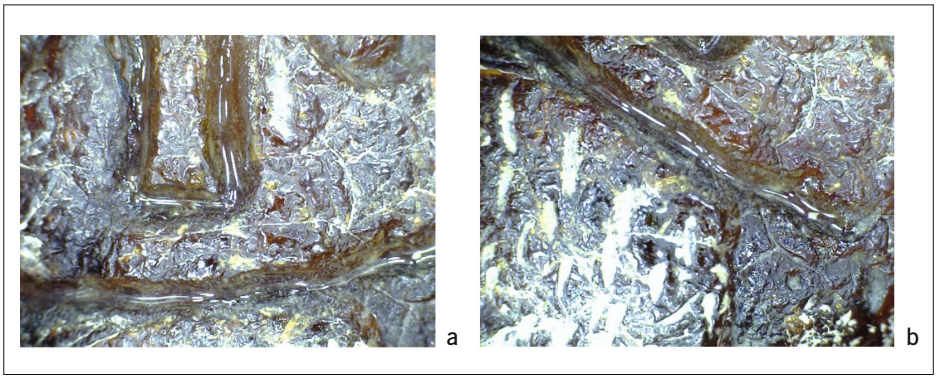

Fig. 19a–b Bernstorf, Freising district, Bavaria. Amber 'face' B10. The clear, smooth, glossy 'varnish' can be seen in the engraved lines on the 'face'. *a* nose and mouth; *b* mouth and engraved beard. The beard cuts contain a 'fine, white powder'. Not to scale.

burnt areas on the other quadrants. The engravings which define the beard show different characteristics to those which define the rest of the face. None of the beard grooves have the clear varnish-like surface, instead they are filled with »[...] eine[m] feinen, weißgelblichen Pulver[...]« *(... a fine, yellowish-white powder ...)* (Fig. 19)[107]. In places this has fallen out of the grooves. See the discussion below for more about this powder. There are some burnt/charred areas along the top of the piece (Fig. 35–37). These do not extend down very far onto the front or rear surfaces. The burning is again consistent with having been deliberately held in a naked flame. Within the burnt area there are »[...] rußige, blasig aufgeschmolzene Zonen [...]« *(... sooty, blistered and melted areas ...)*[108]. As mentioned above, there is a small amount of charring on the central character on the rear side.

The 'face' was selected for fluorescence testing. The results were reported as follows: „Im Bereich der alten, krustig schrundigen Bernsteinoberfläche sind keine Fluoreszenzerscheinungen unter UV-Licht zu beobachten. Die Gravuren setzen sich davon etwas heller ab, im Bereich der glatten, abgeschmolzenen Stellen wirkt die Oberfläche unter UV-Licht wie mit einem sehr schwachen, leicht milchigen Schleier überzogen [schwache Fluoreszenzerscheinung]." *(In the area of the old, crusty wrinkled amber surface, no fluorescence was observed under UV light. In the smooth, melted areas the engravings appear somewhat lighter under UV light as if covered by a very weak, slightly milky veil [weak fluorescence].)*[109]. See the discussion below for more about the fluorescence.

6.5 The 'seal' (B11)

This engraved piece of amber, the 'seal', was discovered one week after the 'face' (B10) by Moosauer and Bachmaier while searching Area 3, approximately 50 metres east of the

107 Gebhard/Rieder 2002, 122.
108 Gebhard/Rieder 2002, 122.
109 Gebhard/Rieder 2002, 122–123.

gold finds (Fig. 1, Table 1). This item is a naturally-formed piece of amber which has had some artificial modification to its shape. On one side, there is a slightly domed surface with four engraved characters[110]. On the opposite side, a natural protuberance has been enhanced by grooves cut around its base to form a stem. Notwithstanding the modifications, the front of the 'seal' is neither symmetrical nor balanced in its shape, but probably conforms quite closely to the original natural shape of the piece. There are several fractures in the body of the piece, including one which travels through the stem. These cracks would have been evident when the piece was selected to be made into what is now interpreted as an important item, possibly part of the equipment of a cult image (see above). Also evident would have been the large, looping crack on the left side of the domed surface. This crack would have materially affected the engraving of both the left-hand and central characters, both of which cut across it (Fig. 20). Unless they wish to use the distressed condition of the amber as an aesthetic feature of the final piece, modern craftspeople would not usually select such an internally fractured piece for an item which involving detailed engraving and far less so for items which would be subjected to applied pressure when in routine use. The strong possibility of breakage, both during manufacture and use, would make the effort involved in its production seem unviable. The author believes that this same consideration would have applied during prehistory. If any other, more homogenous, raw amber material was available, then, as a matter of routine, that would be selected instead, even if more work was needed to produce the required shape. That this piece was chosen despite its obvious faults, suggests that there was only a very limited choice of amber raw material available to the craftsperson who made it.

This piece of amber is not completely translucent. There are some natural pieces of organic material which were trapped inside when the resin was originally exuded from the tree. These can clearly be seen within the body of the piece and should not be confused with the area of superficial burning along the left-hand edge, as viewed from the

Fig. 20 Bernstorf, Freising district, Bavaria. Perforated amber 'seal' B11. The engraved lines of the 'seal' run across the winding loop of an old fracture. Not to scale.

110 Apparently not Linear B script, as only the 'seal' characters are described as such in Gebhard/Krause 2016, 128.

front side with the characters. Again, the burning is consistent with having been held in a naked flame for a short time.

One of the distinguishing features of the 'seal' when it was recovered was that it was embedded in a 'Tonklumpen' *(lump of clay/clay envelope)*[111]. As mentioned above, Moosauer remarked that this type of clay/sediment envelope was identical to those within which some of the gold finds had been discovered. The envelope surrounding the 'seal' was damaged, which allowed the amber inside to be seen and thus recovered[112]. See the discussion below for more about the sediment envelopes. Gebhard reported: „Unmittelbar nach der Ausbettung wirkte das Objekt wie neu." *(When the 'seal' was removed from its sediment envelope, it had initially looked like new.)*[113]. In the following six weeks, the condition of the surface altered visibly and materially, requiring the piece to be stored in light- and oxygen-controlled conditions. Subsequent weathering to the item has been retarded by its storage conditions in the museum. It is worth remarking that the very fresh nature of the surface is mirrored by the completely unweathered nature of the fractures which reach up to the surface. Cracks and fractures such as these would provide the initial pathways along which weathering would enter into the body of the piece, but this has not happened here. Most importantly, this applies also to the large, looping crack on the front surface which was already in place when two of the characters were engraved across it (Fig. 39b).

There are numerous production marks on the 'seal' which relate to the artificial shaping referred to above. The edges of the front side of the piece were trimmed and the whole surface subsequently polished. This polishing was neither effective enough to remove all traces of the trimming tool-marks nor a multitude of scratches on the surface. See the discussion below for more about the production marks remaining on the amber. The interior of the engraved lines do not exhibit the same varnish-like surface as on the 'face'. Instead, Gebhard and Rieder[114] noted: „[...] unmittelbar auf dem Bernstein aufliegend, [befindet sich] ein feines weißes Pulver." *(... a fine, white powder lying directly on the amber)*. See the discussion below for more about this powder. The damage around the entrances of the perforation show that it was made after the grooves had been made around the base of the stem (Fig. 21). The carving of these grooves clearly cuts directly across several internal fractures which come to the surface at this point. Worryingly for any user of this item, there is a fracture across the body of the stem which threatens to break apart across the perforation if pressure is applied to it; as would be expected during the routine use of a seal for instance. Gebhard and Rieder[115] suggested that the groove around the base of the stem may have been used to hold some kind of fastening device or cord to attach the seal to another object, or to suspend it on a thread[116]. If that was the intention, then the sharp edges and a complete lack of wear on the grooves shows that this procedure was never carried out.

The 'seal' was selected for fluorescence testing. The result given was: „Die Oberfläche weist unter UV-Licht schwache Fluoreszenzerscheinungen auf, sie erscheint wie mit einem milchigen Schleier, überzogen. [...] Die Oberfläche der Rückseite weist schwächere

111 Moosauer/Bachmaier 2005, 106 Fig. 1.
112 Gebhard/Krause 2016, 63 Fig. 22; 119 Fig. 76. The ASM refused the author's request to include these figures in this report, as is their right. The author recommends that the reader view the original figures.
113 Gebhard/Rieder 2002, 124.
114 Gebhard/Rieder 2002, 125.
115 Gebhard/Rieder 2002, 125.
116 Possibly in the same way as a 'duffle-coat' toggle, or on a lanyard.

Fig. 21 Bernstorf, Freising district, Bavaria. Perforated amber 'seal' B11. Fractures around the perforation and the 'stem' showing the groove cutting across them. Not to scale.

Fluoreszenzerscheinungen als die Schauseite auf. Eine starke Fluoreszenz zeigt sich an der kreisrunden rezenten Abplatzung neben dem Bohrloch." *(The surface fluoresced weakly, it appeared as if covered by a milky veil. … The surface of the back is less fluorescent than the engraved side. There is strong fluorescence in the recent circular area of damage next to the perforation.)*[117]. See the discussion below for more about the fluorescence.

7 Discussion

7.1 The quantity of amber at Bernstorf

Gebhard says of the 56 pieces of amber reported from Bernstorf: „Es handelt sich damit um die umfangreichsten Bernsteinfunde in einer Siedlung in Süddeutschland, wahrscheinlich sogar weit darüber hinaus. Ursprünglich waren es sehr viel größere Mengen, wenn man sich den Filter der Fundüberlieferung vergegenwärtigt." *(This is the most comprehensive amber find from a settlement in southern Germany, probably even far beyond. Originally, there would have been much larger quantities, if one considers the circumstances of the find situation.)*[118]. Even apart from the speculative and unverifiable assertion that larger quantities were originally present, a more considered appraisal of this statement shows it be optimistic. As noted above, the present author believes that the 37 small, unworked pieces (B02a, B02b, B12) can be discounted as there is no archaeological evidence to attribute them to any prehistoric activity at Bernstorf. Rather than 56 pieces, then, there are only 19 pieces of amber found on site in locations where they *might* have been associated with Bronze Age contexts. Only one of these 19 (B19) has been tentatively associated with an archaeological feature (i. e. the Bronze Age earth and timber wall), but it was unworked and not found *in situ* in a primary context. None of the other amber can be dated by archaeological context to the Bronze Age. Eight pieces were

117 Gebhard/Rieder 2002, 125–126.
118 Gebhard/Krause 2016, 138–139.

worked, and six of those have only a simple perforation. 11 pieces were unworked. Simply in terms of quantity of worked material, Bernstorf would rank far below the total number of worked Bronze Age amber artefacts at, for example, the Bavarian sites of Ingolstadt (2000+ pieces)[119] or Asenkofen (25 pieces)[120]. Gisela Woltermann has catalogued all the prehistoric amber recorded in Germany from the Palaeolithic to the end of the Bronze Age[121]. Excluding the entry for Bernstorf itself (Woltermann Cat. 111), of the 37 other entries across all time periods reported with raw amber[122], the largest specified amounts[123] come from Luckaer Forst, Hügel 10 (Tumulus 10), Thuringia (unallocated period) (75 pieces) (Woltermann Cat. 976) and Thalmassing, Bavaria (Urnfield Culture) (>20 pieces) (Woltermann Cat. 196)[124].

7.2 Provenance of the Bernstorf amber

The first piece of amber (B01) was discovered at Bernstorf during the Moosauer/Bachmaier excavation in 1997. As amber is not found naturally in the locality, it was submitted by Moosauer to Dipl. Ing. Gerhard Heck[125] for Py-GC analysis[126] to determine what type of amber it is. The authors reproduce Heck's analytical results as a graph[127]. Their text reports Heck's result as „[...] baltischen Bernstein, wahrscheinlich aus dem Bereich von Usedom (entsprechende weitere Referenzproben aus diesem Gebiet liegen vor)" *(... Baltic amber, probably/presumably/likely[128] from the region of Usedom (corresponding further reference samples from this area are available))*[129]. Usedom lies on a coastal spit at the mouth of the West Oder river, on the German Baltic coast. It is reported that amber can be found on several of its beaches[130].

Even though Moosauer and Bachmaier are not experts on these matters, it is interesting that they suggest that the amber item B01, 'wahrscheinlich' *(probably/presumably/*

119 Bankus 1998.
120 Wenzl 1907.
121 Woltermann 2016.
122 Although it should be noted that it may be that not all excavators recorded/reported in their published accounts the exact quantity of raw amber, if any, which had been discovered.
123 Excluding the Bernstorf entry itself.
124 Woltermann 2016, 313–378 Catalogue; 381–382 Appendix 2 - Chronological order of finds. The seven other places where a specific quantity of raw amber has been noted are: (Woltermann Cat. 864) Nebel, Amrum, Schleswig-Holstein (Period III) (10 pieces); (Woltermann Cat. 970) Donndorf, Kyffhäuser, Thuringia (Corded Ware Culture) (eight pieces); (Woltermann Cat. 623) Bischofswerda-Belmsdorf, Bautzen, Saxony (Period IV–V) (three pieces); (Woltermann Cat. 812) Höbek, Haßmoor, Schleswig-Holstein (Period II) (two pieces); (Woltermann Cat. 841) Keitum, Sylt-Ost, Schleswig-Holstein (Funnel Beaker Culture/TBK) (two pieces) and (Woltermann Cat. 240) Bergedorf, Hamburg (Funnel Beaker Culture/TBK) (two pieces). There are 32 other sites with an unspecified amount of raw amber, of which 19 are dated to the Bronze Age (12 to Periods I–VI; one each for BzA, BzB, BzC and Urnfield; three are of unspecified date within the Bronze Age). There are also five additional sites where there is a suggestion that raw amber might have been found, of which two are dated to the Bronze Age, both BzC.
125 Moosauer/Bachmaier 2005, 57; Moosauer et al. 1998, 278 refer to the analysis being done by 'R. Heck', but their bibliography names 'G. Heck' as the author of the papers cited.
126 Pyrolysis-gas chromatography.
127 Moosauer/Bachmaier 2005, 58 Fig. 82.
128 *'wahrscheinlich'* can be translated to any of these adjectives.
129 Moosauer/Bachmaier 2005, 57.
130 The local tourist industry attracts holidaymakers to the area with the prospect of finding amber on the beaches. Can amber be found at Usedom? <http://www.usedom-net.de/natur/bernstein-auf-usedom-finden.html> (22.02.2017).

likely) came from the Usedom area. The text is written in such a way that it implies that Heck has made this suggestion, reinforcing this idea by stating that further, presumably corroborating, analytical samples have already determined that this detailed level of attribution is possible. As seen above, however, Baltic amber is found over a very wide region right across northern Europe from the east coast of England to Russia. In none of these locations can it be analytically differentiated from any other deposit of Baltic amber[131]. The papers referenced by Moosauer and Bachmaier for Heck's analysis[132] do not specifically refer to the amber from Bernstorf. Rather they detail the analytical methods used to identify different fossil resin sources in Europe (which have chemical compositions different from each other and from Baltic amber) and the rest of the world (e. g. Mexico and the Dominican Republic to name just two). In fact, when talking about a fossil resin from Eastern Galicia, Heck makes it clear: „Schließlich ist nicht anzunehmen, daß sich eine eigene Art von Bernstein nur an einem bestimmten kleinen Ort gebildet hat. Existiert eine solche Art, ist sie gewiß über ein größeres Gebiet verbreitet, [...]" *(... it should not be assumed that a certain* [i. e. analytically differentiated] *sort of amber will derive only from one small place/location. If there is such a kind [of amber] it is certainly spread over a wide area ...)*[133].

All this being the case, it is highly unlikely that any analyst with a working knowledge of European fossil resins would have independently offered a provenance of Usedom for any piece of Baltic amber. If someone had asked whether this piece of amber *could* have originated in Usedom, the answer would have to be 'Yes, that is possible', but, of course, this same answer could be given for any suggested location between eastern England and the Ukraine. This situation is well known amongst amber researchers and has for many years been a source of frustration when considering those archaeological artefacts made of Baltic amber which are found further south[134]. Notwithstanding all of the above, Moosauer and Bachmaier[135] make a great deal of the supposed Usedom provenance. They discuss the distances between Bernstorf and Usedom as well as between Usedom and Mycenae. On the same page, they include a separate box devoted to „Bernsteinhandel in der Bronzezeit am Beispiel der Region Usedom" *(Bronze Age amber trade in the Usedom region)*. They consider what the ancient Usedomers might have traded in return for metal ores from further south. Their conclusion is: „Ohne Zweifel natürlich Bernstein, der die Region im Altertum so berühmt machte und sehr begehrt war." *(Without doubt it was amber, which in ancient times made the region so famous and was highly sought after.)*. Their confident statement about provenancing this piece of Bernstorf amber to this one location is surprising (and problematic) as it cannot be attributed to Heck's analysis of B01, for the reasons noted above. Gebhard and Krause take the same view[136].

More recently, Christoph Lühr[137] has analysed 13 samples of amber from Bernstorf, including samples from several unworked pieces and the 'seal' (B11), all of which gave a result of Baltic amber. He does not attempt to assign a more detailed provenance to these pieces.

131 Beck 1966.
132 See Heck 1996; Heck 1997; Heck 1999.
133 Heck 1996, 164.
134 Beck 1966; Wolfe et al. 2016.
135 Moosauer/Bachmaier 2005, 60.
136 Prof. Krause, pers. comm. 2016.
137 Lühr 2012, 35.

7.3 Weathering, amber dust and soil remnants

In most of the engraved lines and cracks in the surface of the Bernstorf amber, a light coloured material can be seen. Gebhard and Rieder described it: „Als durch die Bodenlagerung entstandenes Verwitterungsprodukt sind die weißen bzw. gelblichen Ablagerungen in den Ritzlinien anzusprechen. Es handelt sich dabei um Bernsteinsäure, die bei der Verwitterung von Bernstein entsteht." *(As white or yellowish deposits in the scribed lines which are to be treated as a weathering product resulting from the prevailing soil conditions. This is succinic acid, which is formed during the weathering of amber.)*[138]. In Footnote 18, they report: „Die Analysen wurden im Rahmen eines Bernstein-Projektes von J. Koller und U. Baumer am Dörner *[sic]* Institut der Bayerischen Staatsgemäldesammlungen durchgeführt." *(The analyses were carried out as part of an amber project by J. Koller and U. Baumer at the Doerner Institute of the Bavarian State Painting Collections.).* Elsewhere in the same paper, Gebhard and Rieder noted these deposits when examining the engraved lines and cracks in the surface of both the 'face' (B10) and the 'seal' (B11). For the 'face', they write: „In den gravierten Rillen befinden sich Reste eines feinen, weißgelblichen Pulvers, in den Rissen und Löchern der Oberfläche Reste feinsandigen Materials." *(In the engraved lines are the remains of a fine yellowish-white powder, in the cracks and holes of the surface is a fine, sandy material.),* (Fig. 35–37)[139]. For their observations on the 'seal', they write: „In den Gravuren befindet sich feinsandiges Material, darunter, unmittelbar auf dem Bernstein aufliegend, ein feines weißes Pulver."[140]. Depending on its context, the English translation of the word 'darunter' can mean either *a* 'including' or *b* 'underneath'. This leaves us with two possible translations. In *a* the sentence reads: *"In the engraved lines and lying immediately next to the amber is found a fine, sandy material, which includes a fine, white powder."*. Translation *b* reads: *"In the engraved lines is a fine, sandy material and underneath, lying directly on top of the amber, a fine, white powder."*[141]. In the present author's draft report (to which the lead authors of the 2016 Bernstorf volume and Rupert Hochleitner and Christian Rewitzer in that same volume refer)[142], the second translation was thought to be the most likely, especially in view of the distinction made between the materials filling the engraved lines and surface cracks of the 'face'. This would mean that for the 'seal' there were two layers of material: *1* a top fine, sandy layer, and *2* a lower fine, white material which was lying directly on top of the amber. It is the presence of this fine, white powder material which needs to be

138 Gebhard/Rieder 2002, 128 with footnote 18. This conclusion is contrary to Gebhard/Krause's argument that the amber at Bernstorf is in such pristine condition because of special soil conditions at Bernstorf.

139 Gebhard/Rieder 2002, 122.

140 Gebhard/Rieder 2002, 125.

141 With thanks to my German colleagues for this information.

142 Gebhard/Krause 2016, 123; Hochleitner/Rewitzer 2016, 265–266. In their papers, both pairs of authors attribute the original (and, they say, erroneous) observation and analysis of this white powder to the present author, but, as is shown here, the original observations and analyses were published by Gebhard/Rieder in 2002. These were the observations which the present author commented on in the draft report. The draft report was an internal document for the ASM and participants at the October 2014 conference and was not written for wider publication. For publication in this journal, it has been extensively rewritten to take into account the new information available in the 2016 Bernstorf volume and the comments on the draft by several readers, including Professor Krause. The author thanks these colleagues for their kind assistance.

addressed. Unlike materials such as iron, the weathering of amber does not produce a dust or powder on the surface which can be brushed off to reveal the original surface beneath. With amber, it is the actual surface which is progressively chemically and physically altered, resulting in an increasingly thick red, and later cream-coloured and opaque crust. This weathered surface eventually cracks and can be removed or falls off, resulting in the complete loss of the original surface from the piece. It is physically impossible for a weathered amber surface to fall off, revealing an original surface on which are visible the very fine striations which can be seen inside the engraved lines of the 'seal' (seen most clearly in Fig. 39e–f; Fig. 40d–e).

Amber dust is produced in prodigious quantities when amber is worked (Fig. 10d). If the fine, white powder from the engraved lines of Bernstorf amber analysed by the Doerner Institute of the Bavarian State Painting Collections is/was succinic acid, then it is likely to have been dust of this sort as it cannot be a weathered surface as Gebhard/Rieder described it. In the light of this fact, the present author suggested in the draft report that this fine, white material was most probably an amber dust, as if it is not one thing (weathering), then it must be the other (dust). The present author does not necessarily suggest that this white powder/amber dust lying in the engraved lines (if it exists/existed – see below) is a remnant of the engraving work which was not removed by the craftsperson at the end of the process. If these items are forgeries, then it could have got there not by accident, but by design as a means of making the items look less modern. Such aging measures are a standard means of achieving this aim.

The material lying in the engravings has recently been reanalysed by Hochleitner and Rewitzer using a scanning electron microscope[143]. Four samples (two from each) were taken from the engraved lines of both the 'face' (B10) and the 'seal' (B11). The results are reported as follows: „Nach diesen Untersuchungen und Befunden kann eindeutig ausgeschlossen werden, dass es sich bei den weißen Füllungen der Gravurspuren um bei dem Vorgang der Gravur erzeugte Bernsteinpartikel handelt. Vielmehr handelt es sich um eingeschwemmte Reste des umgebenden Bodens." *(According to these results, it can be conclusively ruled out that the white material in the engraved lines are amber particles, rather they are illuvial residues of the surrounding soil [envelope].)*. This is an interesting result which provides for two scenarios. Either: *1* Gebhard and Rieder and the analysts from the Doerner Institute were incorrect in their observations and chemical analyses reported in 2002. There was no fine, white amber/succinic acid powder which could be interpreted as weathered amber; or *2* Gebhard and Rieder and the Doerner Institute *were* correct in their observation of two layers of material filling the engraved lines and a chemical determination of succinic acid, and, thus, the samples tested by Hochleitner and Rewitzer were taken exclusively from the fine, sandy material in the upper layer of the engraved lines or elsewhere. If the second scenario is the case, there *was* a fine, white material which Gebhard and Rieder interpreted as weathered amber[144]. That amber, however, cannot have been the result of weathering for the reasons noted above and the present author's suggested interpretation of this material as amber dust remains a valid option.

143 Hochleitner/Rewitzer 2016, 265–266.
144 Gebhard/Rieder 2002, 128.

7.4 Fluorescence detected on the Bernstorf amber

As noted above, amber which has been recently damaged, cut or polished fluoresces intensely blue under UV light[145]. This fluorescence fades after a period of a few months. Conversely, weathered amber does not fluoresce at any stage. There have been two series of UV fluorescence tests on the amber from Bernstorf. In January 2001, the amber which had been recovered up to that date was tested[146]. The 'face' (B10) and the 'seal' (B11) were tested again for the 2016 Bernstorf volume[147]. The published results and (differing) interpretations resulting from the two test series are reported here in chronological order.

In 2001, the stated aim of the tests was: „Um die Authenzität *[sic]* der Stücke nachweisen zu können, muß das Phänomen der Restfluoreszenzerscheinungen bei beiden Objekten, vor allem bei dem Siegel, betrachtet werden." *(In order to prove the authenticity of the pieces, the phenomenon of residual fluorescence must be considered in both objects, and especially in the case of the seal)*[148]. As the more significant pieces, the results for the 'face' (B10) and 'seal' (B11) were reported first. The result for the 'face' stated: „Im Bereich der alten, krustig schrundigen Bernsteinoberfläche sind keine Fluoreszenzerscheinungen unter UV-Licht zu beobachten. Die Gravuren setzen sich davon etwas heller ab, im Bereich der glatten, abgeschmolzenen Stellen wirkt die Oberfläche unter UV-Licht wie mit einem sehr schwachen, leicht milchigen Schleier überzogen (schwache Fluoreszenzerscheinung)" *(In the area of the old, crusty wrinkled amber surface, no fluorescence was observed under UV light. In the smooth, melted areas the engravings appear somewhat lighter under UV light as if covered by a very weak, slightly milky veil (weak fluorescence).)*[149]. The term „etwas heller" *(somewhat lighter)* is a rather ambiguous and relative term, especially as there was no fluorescence observed on the weathered surface.

The results for the 'seal' were reported as: „Die Oberfläche des gesamten Stückes wurde [...] poliert. [...] Die Oberfläche weist unter UV-Licht schwache Fluoreszenzerscheinungen auf, sie erscheint wie mit einem milchigen Schleier 'überzogen'. [...] Die Oberfläche der Rückseite weist schwächere Fluoreszenzerscheinungen als die Schauseite auf. Eine starke Fluoreszenz zeigt sich an der kreisrunden rezenten Abplatzung neben dem Bohrloch." *(The entire surface of the piece is ... polished. ... The surface fluoresced weakly, it appeared as if covered by a milky veil. ... The surface of the back is less fluorescent than the engraved side. There is strong fluorescence in the recent circular area of damage next to the perforation.)*[150]. See Figure 22 and Figure 23 for drawings of the 'face' and 'seal' under UV light in the recent ASM fluorescence tests[151]. Their recent fluorescence results mirror the published fluorescence results for 2001, although as there are no published photographs of the 2001 test, it is not possible to make a comparison of the difference between the strength of the fluorescence on the two occasions. The published interpretations from the recent tests are discussed below. There was no explicit discussion of the significance of the fluorescence seen on the 'face' and 'seal' in the 2002 paper. In the 2001 test, as a comparison for the fluorescence seen on the 'face' and 'seal', the other amber

145 Ganzelewski 1996b, 25.
146 Gebhard 2002, 127–128.
147 Gebhard/Krause 2016, 124.
148 Gebhard 2002, 127.
149 Gebhard 2002, 122–123.
150 Gebhard 2002, 125–126.
151 Gebhard/Krause 2016, 124 Fig. 79; 126 Fig. 81; 127 Fig. 82. The ASM refused the author's request to include these figures in this report, as is their right. The author recommends that the reader view the original figures.

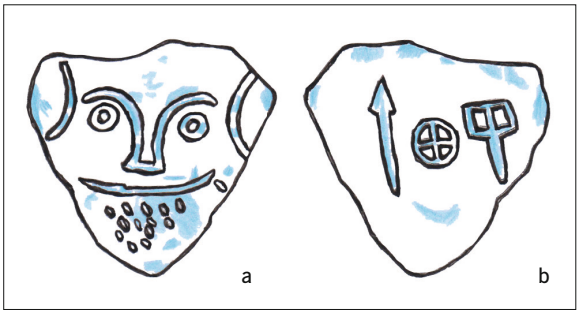

Fig. 22a–b Bernstorf, Freising district, Bavaria. Amber 'face' B10. Schematic sketch showing the locations of the fluorescence (shown in blue) exhibited by the 'face' during the recent ASM test. *a* front; *b* rear. Not to scale.

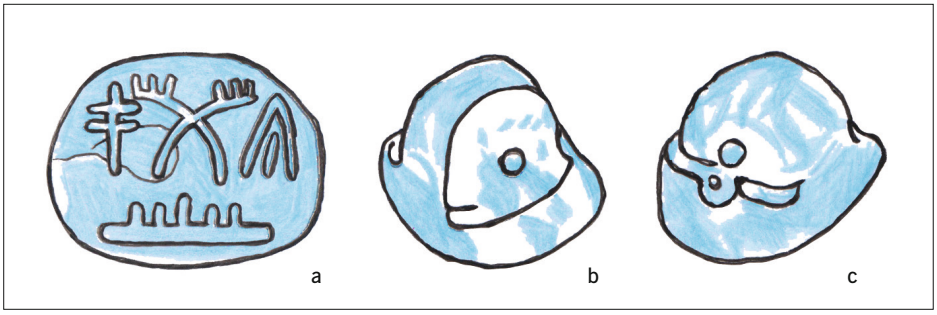

Fig. 23a–c Bernstorf, Freising district, Bavaria. Perforated amber 'seal' B11. Schematic sketch showing the locations of the fluorescence (shown in blue) exhibited by the 'seal' during the recent ASM test. *a* front view; *b* view of rear from left; *c* view of rear from right. Not to scale.

from Bernstorf which had been found up to that date was also tested, along with "[m]ehr als 100 prähistorische[n] und römische[n] Bernsteinobjekte[n] aus den Beständen der Archäologischen Staatssammlung München, die seit 30 bis 100 Jahren unter normalen Umweltbedingungen aufbewahrt wurden" *(more than 100 prehistoric and Roman amber objects which had been stored in the ASM under normal environmental conditions since between 30 and 100 years)*[152]. The results were: - *1* the 'six amber objects' (B03–B08) were all reported as follows: „Die Stücke weisen partiell schwache Fluoreszenzerscheinungen an der Oberfläche auf, im Bereich der Bohrungen sind deutliche Fluoreszenzerscheinungen feststellbar [9.1.2001]." *(These pieces have partially weak fluorescence at the surface, and around the perforations distinct fluorescence phenomena were detected (9.1.2001).)*; - *2* 20 [*sic* – actually 26] small, unworked amber pieces (B02b) found 100 metres west of the 1998 gold finds - none of these showed any fluorescence; - *3* the small, amorphous piece (B09) found on 11.11.2000 with the 'seal' [*sic* – see Table 1]. For this piece it is noted:

152 Gebhard 2002, 127. The aim of testing the pieces which had been a long time in the museum store is likely to have been as a control group to show the difference between weathered amber (as the amber from the store would have been if it had been stored under uncontrolled, and thus disadvantageous, environmental conditions for a long period) and the recently recovered amber from Bernstorf, although this aim is not explicitly noted in the 2002 article.

„Es weist eine frische Beschädigung auf, die stark fluoresziert. Die unbeschädigte, glatte Oberfläche weist leichte Fluoreszenzerscheinungen auf [2.1.2001]." *(There is fresh damage which fluoresces strongly, while the undamaged, smooth surface fluoresces slightly [2.1.2001].);* and - *4* the six pieces of amber picked up in November 2000 (here B12), showed a slight fluorescence. In contrast, none of the prehistoric or Roman amber showed any fluorescence at all.

In order to explain why some of the Bernstorf amber fluoresced in this way when it might be expected (if it was from the Bronze Age) to exhibit no fluorescence at all, Gebhard concluded that these observations could not be taken as evidence that these pieces of amber had been recently worked or damaged because he writes: „Es kann festgestellt werden, daß andere Bersteinobjekte *[sic]* vom Fundort Bernstorf Fluoreszenzerscheinungen aufweisen und damit die Fluoreszenz an sich nicht als Anhaltspunkt für eine Fälschung dienen kann, sondern hier primär als Hinweis auf eine besondere Bodenlagerung zu deuten ist." *(It can be established that other amber objects from the locality of Bernstorf exhibit this fluorescence phenomena and thus the fluorescence itself cannot serve as a point of reference for counterfeiting, but is to be interpreted here primarily as an indication of special soil conditions.)*[153]. He does not explicitly state which are these other amber objects from the Bernstorf locality that also fluoresce, but it may be that he is referring to the fluorescence seen on the 'face' and the 'seal'. If so, then this is a classic circular argument, namely the fluorescence seen on the B02b, B03–B09, and B12 cannot be taken as evidence of modern working/damage but is due to special soil conditions, and this conclusion is proven because there is also fluorescence on the 'face' and 'seal'. As the 'face' and 'seal' are also from an unstratified context and are also under suspicion of forgery, however, they cannot be used to authenticate the other amber which fluoresces.

On the other hand, it may be that Gebhard means that there are other pieces of amber which fluoresce from the Bernstorf locality which are completely separate from the Bernstorf amber assemblage considered here. In Woltermann's catalogue of prehistoric amber from Germany[154] the only entry for the immediate Bernstorf area is for the amber under discussion here (Woltermann 2016, Cat. 111 – Bernstorf). The next nearest entry geographically is at Asenkofen, Freising district (Woltermann 2016, Cat. 99–100), some 18 km east of Bernstorf[155]. For the purposes of Gebhard's argument about special soil conditions in this immediate area, eighteen kilometres distant would not seem to be in the Bernstorf locality. Also there is no published record that these pieces have been tested for fluorescence. Amber finds from archaeological sites of the Iron Age or later periods do not appear in Woltermann's catalogue, so it is theoretically possible that there is other archaeological amber to which Gebhard may have been referring. As it is, however, Gebhard does not offer any supporting evidence or references for what this other amber from the locality might be, nor for the conclusion about the presence of special soil conditions at Bernstorf.

A more straightforward explanation would have been that the unworked amber (B12) with minimal traces of fluorescence were found lying on the ground surface and could

153 Gebhard 2002, 128.

154 Woltermann 2016.

155 This is the Bronze Age amber (including spacers) excavated in 1904 (Wenzl 1907). The amber from Asenkofen is housed in the collection of the Freising Historical Association and in 2010 was studied by the present author for her PhD on Bronze Age amber spacers (Verkooijen forthcoming). The next nearest four catalogue entries are all around 45 km distant from Bernstorf.

have had their surfaces damaged by the action of machines clearing the tree cover and by that unearthing them[156]. B09 could have suffered similarly and also exhibits some recent breakage. In addition, it appears that some of these small pieces were collected in more than one recovery episode, but delivered to the ASM together. They may have been stored in the same container/bag between recovery episodes and may have had their surfaces damaged by friction between the items themselves. It should be noted, however, that some of these pieces exhibited no fluorescence at all. As mentioned above, the author believes that the small amber pieces catalogued under B02a, B02b and B12 should be disregarded from the Bernstorf amber assemblage, therefore the only fluorescence results which are relevant are from the worked pieces, i. e. the 'six amber objects' (B03–B08), the 'face' (B10) and 'seal' (B11). The fact that fluorescence is shown in the majority of the engraved lines on the 'face' and 'seal'[157], on the highly-polished front of the 'seal', is present in the interior of the 'seal' perforation (as well as on the damage around the edges), and the perforation entrances of the 'six amber objects', is significant. This is exactly what is to be expected if these pieces had been worked recently, i. e. in modern times. Gebhard's contention that the weathered surface of amber also fluoresces is factually incorrect and his interpretation which follows from that, that the amber was worked in the ancient past, cannot be sustained.

7.5 Production traces on the worked amber from Bernstorf

Gebhard and Krause state: „Die Untersuchung von Bernstein auf herstellungsbedingte Spuren oder sein archäologisches Alter ist schwierig und es gibt wenige Untersuchungsmöglichkeiten, die Echtheit von Bernsteinartefakten zu überprüfen." *(The investigation of amber for production-related traces or its archaeological age is difficult and there are few possibilities to check the authenticity of amber artefacts.)*[158]. This is partially correct. Determining the archaeological age of such traces is difficult, if not impossible, and not only because items may have been reworked at several points in their use-life. Tool-marks and other manufacturing traces may also have been removed as part of the finishing stage of production. As shown above, it is not possible to use fluorescence testing for that purpose. Determining the age of modern working encounters the same problems once the amber has weathered past the point where it no longer fluoresces.

It is, however, possible in the present day to use experimental archaeology procedures to check the types of production traces which are made in amber by tools of various types and materials. Gebhard and Rieder report the results of such experiments with regard to cutting amber using metal or flint blades, using high-powered microscopic examination to come to their determination[159]. Unfortunately, most of the prehistoric amber curated in museums dates from a time when the necessity of retarding the weathering process in the museum store was unknown. This makes the physical condition of the surface of most archaeological amber too degraded (or missing) (Fig. 5) for such examination. In a very few artefacts from secure Bronze Age contexts, however, such traces have been found[160]. In

156 Bähr 2016, 269.

157 The engraved lines of the beard on the 'face' do not show fluorescence probably because they still contain soil remains.

158 Gebhard/Krause 2016, 123.

159 Gebhard/Rieder 2002, 121–122.

general terms though, the possibilities are distinctly remote for the successful comparison at the high-powered microscopic scale of modern experimental results of production traces and any ancient production traces which might remain.

In the 2016 volume, Gebhard and Krause compare a perforation made in amber using a modern machine-driven metal drill-bit with the conical perforations of the 'seal' (B11)[161]. They conclude: „Die moderne Bohrung [...] tritt scharfkantig und senkrecht in den Bernstein ein. Im vollkommen zylindrischen Loch befinden sich scharfkantige Stufen. [...]" *(The modern bore [2016, Fig. 86,4] ...enters the amber in a sharp-edged and perpendicular manner... [producing] sharp-edged stepping in the perfectly cylindrical hole).* In contrast, regarding the entrances to the perforations of the 'seal': „Das Eintrittsloch ist unregelmäßig und stark aufgeweitet. Die Oberfläche im Inneren des Lochs ist teilweise schrundig. [...]" *(The entry hole is irregular and greatly widened. The surface inside the hole is partially cracked).*

Their conclusion on comparing these two examples is that: „Der deutliche Unterschied zu den bei der Bergung vorhandenen Bohrungen der durchlochten Bernsteine zeigt, dass diese keinesfalls in einer modernen Technik erstellt wurden." *(The clear difference to the bore holes of the recovered perforated amber shows that this is by no means a modern technique.).*

The author's own experimental examples (Fig. 12) show that it is possible to drill amber using a hand-driven pump-drill with flint, bone or the Bronze Age metal composition of 12 % tin-bronze drill-bits to produce sharp-edged, perpendicular perforations with perfectly cylindrical holes. Wiggling a modern drill with a metal bit running at slow speed produces a conical entrance hole and angling the drill slightly part-way through the process produces a section at an oblique angle to the main direction[162]. The fact the author has produced these experimental examples, shows that all these outcomes are possible using both modern techniques with machine tools and also with drills and drill-bits in materials appropriate to the technologies available in the Bronze Age. Thus Gebhard's use of his examples to support an interpretation of the 'seal' as being of ancient manufacture cannot be sustained. As noted above, only one of the perforations in the 'six amber objects' (B03) (Fig. 16) is conical in shape. All the other perforations either enter the amber with clearly sharp-edged, circular holes, or they have been subjected to recent damage (all unweathered) around the perforations giving them the appearance of being conical at first glance. This is especially clear in B08, where the circular pressure scars seen in the damaged area are typical of the type produced by rotational torque, for instance, by drilling (Fig. 33b).

A close examination of the X-ray images of the 'seal' (showing the gold strips *in situ* inside the perforation) (Fig. 24)[163] also shows that the perforations are not as conical as may be

160 This specific investigation was one of the research topics of the author's PhD looking at Bronze Age amber spacers. These results will be presented there (Verkooijen forthcoming).

161 Gebhard/Krause 2016, 130; 130 Fig. 86.1–4.

162 This is always a hazard with a hand-held drill. To produce reliably straight holes requires the use of a static drill-stand. The author has not tried this technique with amber, but has done the same thing many times while working with wood.

163 Gebhard/Krause 2016, 98 Fig. 54. The ASM refused the author's request to include this figure in this report, as is their right. The author recommends that the reader view the original figure. Reading X-ray scans is a skill as the various processes (in both digital and wet film processing) can produce so-called visual artefacts (such as parallax shadows or radiation backscatter) which can mislead the viewer (O'Connor/Brooks 2007, 88). One aspect of the author's PhD research was to obtain X-ray images of the Bronze Age amber spacers. In preparation for this, she trained with Dr. Sonia O'Connor at the University of Bradford on the capture and interpretation of X-rays for archaeological objects.

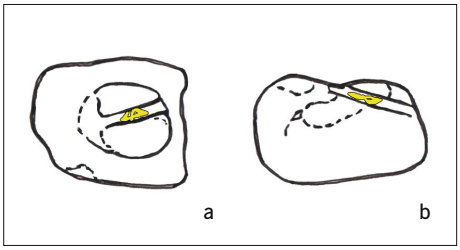

Fig. 24a–b Bernstorf, Freising district, Bavaria. Perforated amber 'seal' B11. Schematic sketch based on the X-ray images of the 'seal' showing the parallel-sided perforation with the gold strips placed inside it. *a* plan view; *b* side view. Not to scale.

thought at first sight. While the entrances on both sides of the perforation are large, the X-ray images show that once they are clear of the entrances, the perforations have straight sides, meaning, that at this point, they have been drilled with a straight drill-bit rather than one with a triangular profile which would have produced a conical perforation along its whole length, as suggested by Gebhard and Krause above.

All the above makes the level of detail visible on the 'seal' from Bernstorf highly atypical of the known Bronze Age amber assemblage. This is especially apparent with the production traces visible on the 'seal'. Even the finest and most delicate scratches remain crisp and fresh after being (allegedly) buried nearly 3400 years at Bernstorf (Fig. 25). In fact Gebhard described it as „wirkte [...] wie neu" *(looked ... like new)* when it was released from its sand/clay sediment envelope at the ASM[164]. In the following six weeks, the condition of the surface began to alter, requiring the piece to be stored in light- and oxygen-controlled conditions. Even today, viewed with the naked eye, the surface could be described as almost pristine.

To explain what would be extremely fine preservation on an ancient artefact, Gebhard suggests that optimal soil conditions in the ground can lead to objects being excavated in their original 'werkfrische Erhaltung' *(factory-fresh)* condition and refers the reader to several examples illustrated in Weisgerber (1996)[165] and one from Roman London. In each of these cases where the archaeological context can be ascertained for these items, they were found in waterlogged conditions, beneficial to the retardation of the weathering process. On all these artefacts, the carving and decoration is clearly defined. All except the Roman amulet have a uniform deep opaque colour (orange, red, or yellow) signifying that they have been subject to the weathering process, even though they have no surface crazing. As Gebhard states, the effects of any restoration work are not detectable in the photographs. This does not mean, however, that no restoration or conserva-

164 Gebhard/Rieder 2002, 124.

165 Gebhard/Krause 2016, 123 with footnote 302; citing figures from Weisgerber (1996) figures: 1996, 417 - a Neolithic pendant from Tvaermose, Eising (bog), Denmark; 1996, 417 - *a* an amber bead from the Bandkeramik well at Erkelenz/Hückelhoven, North Rhine-Westphalia, Germany; *b* the Hove amber cup from an oak coffin burial, East Sussex, United Kingdom; 1996, 421 - three Roman fibula brooches with amber decoration from Verucchio, Italy; 1996, 423 - a carved amber figure from Nijmegen, Netherlands; 1996, 424 - *a–b* two carved amber figures from Aquincum, Hungary; *c* a Roman bead necklace from Hambach, North Rhine-Westphalia, Germany. Gebhard/Krause 2016, 123 footnote 302 also draws attention to, but does not name, the objects in the figures in Weisgerber 1996, 418 - these are the amber spacer necklaces from Upton Lovell, Wiltshire, United Kingdom and Shaft Grave Omicron in Grave Circle B at Mycenae, Greece. As the author studied these objects for her PhD, she can vouch from personal experience that these two necklaces are not in *'factory-fresh'* condition and do not show any signs of their original manufacturing process.

Fig. 25a–d Bernstorf, Freising district, Bavaria. Perforated amber 'seal' B11. Details of production tool traces on the 'seal'. These sharp, clear tool traces are cut into the pristine surface of the amber. *a* Sets of parallel grooves with consistent spacing; *b* sets of parallel grooves with consistent spacing overlain by ultra-fine striations; *c* area shown in b seen from a different orientation; *d* a set of parallel grooves inside the scarring around one entrance to the perforation. Not to scale.

tion work has taken place[166]. Gerd Weisgerber's figures mainly come from exhibition catalogues where it would be expected that items would be presented in their best condition. The best preserved of the examples to which Gebhard refers is the gladiator's helmet amulet from Roman London, which appears translucent and freshly carved. It was found along with a great quantity of well-preserved organic material dating from all periods of Roman Britain[167]. The site was completely waterlogged as it was at the location of the original Walbrook stream, whose course has been buried under the city streets for

166 The European Confederation of Conservator-Restorers' Organisations Professional Guidelines (1) state: "Conservation consists mainly of direct action carried out on cultural heritage with the aim of stabilising [the] condition and retarding further deterioration. Restoration consists of direct action carried out on damaged or deteriorated cultural heritage with the aim of facilitating its perception, appreciation and understanding, while respecting as far as possible its aesthetic, historic and physical properties.", <http://www.ecco-eu.org/fileadmin/user_upload/ECCO_professional_guidelines_I.pdf> (20.02.2017).

167 The web link given in Gebhard/Krause 2016, 123 footnote 302 for this Roman example is no longer active. See instead <https://www.archaeology.co.uk/articles/londons-pompeii.htm> (20.02.2017).

centuries. While this last example certainly proves the point about optimal storage conditions in the ground preserving original fine features, the waterlogged conditions which this requires are very unlikely to be found on the top of a hill comprised of sand and gravel, especially where the item concerned has been lying loose in the soil. Gebhard and Krause's hypothetical scenario for specific ground structures and processes by which the 'seal' and some of the gold came to be encased in their sand/clay envelopes[168], is insufficient to substantiate their claim that the pristine condition of the 'seal' is a result of it having been in optimal waterlogged conditions for 3400 years (see below).

7.6 The sediment envelope surrounding the 'seal'

When excavated, the 'seal' was embedded in an envelope of sand/clay sediment, which was still in place when handed over to the ASM[169]. In contrast, any soil adhering to the 'face' had been cleaned off by the finders prior to handing over to the ASM (see above). The sediment envelope from the 'seal' was stored at the ASM and later used for comparison with other soil samples taken from the site. Three questions were asked in relation to the sediment envelope from the 'seal': *1* Can the sediment be assigned confidently to the site location? *2* Can the material be assigned to a particular soil horizon at the site? and *3* Can the sediment be dated?[170] Various scientific investigations were carried out by different researchers. It was impossible to obtain exactly analogous soil samples from the site for comparison as, at that stage after a decade or so since the items were discovered, the original locations had already been lost to the gravel extraction[171]. In any case, all the finds were found lying in secondary contexts.

Astrid Röpke[172] examined 22 soil columns[173] from the site for their soil development structures, mineral and grain composition, and organic inclusions and compared them to the sediment from the 'seal' envelope[174]. The results showed that: the 'seal' sediment contained inclusions of non-charred plant residues and the presence of hyphae of fungi or streptomycetes. Only the 'seal' sediment and the soil samples from the recent surface of the forest floor contained both of these two organic elements and neither element was found in any of the other soil horizon samples[175]. The comparable soil column to the 'seal' sediment, in terms of soil mineral and grain characteristics, was from Section 7[176]. This had a pH of 4 (extremely acidic). The pH values recorded near the surface were in the range „[...] stark sauer bis sehr stark sauer [...]. Mit zunehmender Tiefe steigen die Werte leicht an." *(... strongly to very strongly acidic ..., and increasing only slightly with depth.)*[177]. Highly

168 Gebhard/Krause 2016, 122; 122 Fig. 78.
169 Gebhard/Krause 2016, 63 Fig. 22; 119 Fig. 76. The ASM refused the author's request to include these figures in this report, as is their right. The author recommends that the reader view the original figures. These envelopes had a smooth surface which resembled giant 'potato gnocchi'.
170 Gebhard/Krause 2016, 120; 119 Fig. 76.3.
171 Wagner et al. 2016, 245.
172 Astrid Röpke, University of Prehistory and Early History, Cologne. Röpke 2016, 217–235.
173 Soil column - „Länge: 60–100 cm, Breite: 10 cm" *(length 60–100 cm, width 10 cm)* Röpke 2016, 218.
174 Compare Röpke 2016, 217 Fig. 1 and Bähr 2016, 267 Fig. 1 for locations of the finds and soil samples.
175 Röpke 2016, 230.
176 Röpke 2016, 219 Tab. 1.
177 Häusler et al. 2016, 241.

acidic sandy soils with high aeration, such as those at Bernstorf, can be expected to result in the complete decomposition of non-carbohydrate organic materials after more than a millennium[178]. As Gebhard was concerned that Röpke's samples were not taken from appropriate locations for this type of analysis, an additional soil sample was collected „[...] ungefähr 150 m westlich der Gold- und Bernsteinfunde [...]" *(... approx. 150 metres west of the gold and amber finds ...)* and from „[...] einer ungestörten Fläche, die vermutlich in den letzten Jahrhunderten nur durch waldbauliche Aktivitäten beeinflusst war." *(an undisturbed area, which in recent centuries, was presumably only affected by forestry activities.)*[179].

The analysts of this sample concluded that all their parameters indicate that the soil horizons from which the gold and amber sediments originated were between 10 and a maximum of 25 cm below the current ground surface[180]. Röpke's and Häusler et al.'s results are therefore in agreement that the soil comes from the Bernstorf hill but are not in agreement about the depth from which it comes. Röpke's results indicate that the soil covering the amber *must* have come from the most recent soil surface. Hausler et al. suggest that it came from either of the next two lowest soil horizons, respectively Ahe and Bhs. Their definition of the modern forest floor (horizon O/Ahe) however, suggests that it is composed of a mixture of both very humic material (O) and material from the second layer (Ahe)[181]. This suggestion is perhaps supported by the following.

With regard to their age, the soil horizon samples and samples from the sediment envelopes were investigated to determine the remaining levels of ^{137}Cs from the Chernobyl reactor accident in 1986[182]. The results showed that while the sediment from one of the gold pieces was most likely to be from a depth of 15–20 cm, the other two (another gold piece and the amber 'seal') were from a very slightly lesser depth[183]. The age of two plant remains in the 'seal' sediment „[...] lässt sich dahingehend interpretieren, [...]" *(... could be interpreted to mean ...)* that the plants had grown in the last 60 years, and, to explain the very recent date, Gebhard concludes: „Das Probenmaterial enthielt demnach rezente organische Bestandteile unterschiedlicher Verwitterungsgrade. [...] Die Stelle des Bodenprofils liegt auf einer ungestörten Fläche, die vermutlich in den letzten Jahrhunderten nur durch waldbauliche Aktivitäten beeinflusst war." *(The sample material contained recent organic constituents of differing degrees of weathering. ... The soil profile lies in an undisturbed area, which in recent centuries, was presumably only affected by forestry activities.)*, i. e. presumably implying that it was mixed with other soil horizons despite the area being described as 'undisturbed'[184]. He also noted that, due to an old root contained in the 'seal' sediment envelope, a younger date had already been expected and further questioned the value of these results in the light of the uncertainty surrounding the depth to which the fallout has penetrated the soil at Bernstorf[185]. Gebhard specifically rejected the dating of the 'recent' conifer needle[186], which was found embedded in the sediment envelope of the 'seal' as not relevant on the grounds that, by that criteria, any archaeological finds found

178 Röpke 2016, 233.
179 Gebhard/Krause 2016, 121; Häusler et al. 2016, 236; 237 Fig. 1–3.
180 Häusler et al. 2016, 243.
181 Häusler et al. 2016, 241 Tab. 7.
182 Wagner et al. 2016.
183 Wagner et al. 2016, 247.
184 Gebhard/Krause 2016, 120; Häusler et al. 2016, 236.
185 Gebhard/Krause 2016, 120–121.
186 ^{14}C date not published, but reported as 'after 1950s' at the Munich conference in October 2014.

near the surface as a result of plough damage would also have to be classified as modern[187].

These results negate, as Gebhard concedes, the original interpretation that the sediment envelopes were manually wrapped around the objects in the ancient past, prior to their burial in a soil layer, and thus that interpretation can no longer be supported and needs to be revised[188]. Gebhard and Krause produce a new, and rather complicated hypothesis, which they present in simplified form in their Figure 78[189], whereby the gold and amber 'seal' were buried in soil horizons which until the end of the Hallstatt occupation period, suffered from repeated disturbance and relocation. After that, according to their hypothesis, ground conditions settled down again and a new period of soil formation began[190]. In the second pictorial element of their Figure 78, the objects are shown as being deposited during the 14th century BC in a pit/cutting through soil horizon levels Ahe and Bhs. According to the figure, the finds supposedly remained loose in the soil within these soil horizons (with their extremely acidic pH values) until 1998, a period of some 3400 years, before being displaced by earth-moving equipment prior to gravel extraction. After this recent displacement episode, in the last pictorial element of their Figure 78 they are shown encased in the sediment envelopes, which presumably formed around them as they were 'rolled' by the displacement of the soil into the earth-root mounds.

This is an interesting hypothesis for two reasons. Firstly, in order for the 'seal' to be so closely encased during the recent earth-moving episodes, it would have had to be lying loose in the soil. Their figure shows the objects moving out of the pit and through the soil column (but still in horizons Ahe and Bhs) from approximately the 6th century BC to the 20th century AD. If this was the case, then why is the 'seal' still in pristine condition despite lying loose in these highly acidic soil conditions? The second consideration is even more telling. Why is it that of all the prehistoric artefacts found in very close proximity in the earth/root mounds, two pieces of gold and the amber 'seal' are the *only* ones to have become very closely embedded in a sediment envelope, whether made of modern soils or not? At the 2014 conference in Munich, Gebhard stated that there were hundreds of these sediment nodules on the site and they had broken open a considerable number of them, hoping to find more artefacts, but that none of these nodules had contained anything archaeological. In order to continue to espouse this hypothesis, which they concede is only hypothetical[191], these questions need to be adequately answered.

7.7 The traces of burning on the amber

It was initially suggested that the heat damage to the gold and amber might be linked to the destruction of proposed (but undiscovered) cult images with which the amber and gold pieces had supposedly been associated[192]. The interpretation at that time was that

187 Gebhard/Krause 2016, 122.
188 Gebhard/Krause 2016, 121.
189 Gebhard/Krause 2016, 122 Fig. 78. The ASM refused the author's request to include this figure in this report, as is their right. The author recommends that the reader view the original figure.
190 Gebhard/Krause 2016, 122; 122 Fig. 78.
191 Gebhard/Krause 2016, 151.
192 Gebhard 1999a, 23.

this fire was the same one which had destroyed the Middle Bronze Age palisade. With regard to the traces of burning on the gold, Moosauer and Bachmaier suggested: „Möglicherweise besteht ein Zusammenhang mit einer verheerenden Brandkatastrophe, der die Umwallung der Siedlung zum Opfer fiel" *(maybe there is a connection with the devastating fire, to which the ramparts of the settlement fell victim)*, although they do not mention the amber[193]. After further examination of the amber, however, it was determined that this burning damage appeared to be deliberate rather than accidental[194]. This was attributed to event(s) perhaps connected with incense burning. If that was the case, then the pieces would have been exposed to a naked flame for a short time only and, obviously, not fully consumed by the fire as is usually the case with incense burning. Having studied the traces of burning on the Bernstorf amber, the author agrees with this interpretation. There remain some outstanding questions, however, which need to be addressed. If all the burning activity relates to the Bronze Age as is suggested[195], what is the mechanism by which B09 and B13 have traces of burning overlying their unweathered surfaces? If the burning is ancient, then these unweathered surfaces cannot be a result of recent damage. If the damage is not recent, however, then why is the amber not more weathered considering the strongly acidic ground conditions at Bernstorf? As mentioned above, on B09 and B13 the traces of burning overly the edge of a completely unweathered surface. This seems to the author to be an unusual situation, considering the highly acidic soils at Bernstorf and the fact that these pieces of amber were found lying loose in the soil.

7.8 Fakes and forgeries

Table 12 of the 2016 Bernstorf volume[196] lists the specific features of the amber and gold from Bernstorf which Gebhard and Krause consider cannot be the result of forgery and which, in some cases they consider to be unforgeable. They also concede, however, that that statement "is partly hypothetical as many features were still unknown prior to the research done in this present study."[197]. There are five table entries (No. 9; 11–14) which relate to the amber. As table entries 11 and 13, and 12 and 14 are the same criteria but applied separately to the 'seal' and the 'face', there are only three issues to be addressed. *1* (Table entry 9) the sediment sand/clay envelope surrounding the 'seal'. It is alleged that a forger would have to *a* know the exact composition of the soil at the site and *b* have specialist knowledge about the Chernobyl fallout. Answer: Just going to the site and collecting the soil would be sufficient to resolve both of these issues[198]. *2* (Table entries 11 and 13) Mycenaean knowledge related to inscriptions/pictographs on 'seal' and 'face'. *a* previ-

193 Moosauer/Bachmaier 2005, 67.
194 Gebhard/Rieder 2002, 122.
195 Gebhard/Krause 2016, 142.
196 Gebhard/Krause 2016, 148–149 Tab. 1.
197 Gebhard/Krause 2016, 149.
198 BR television programme 'Kontrovers' report: „Der Schatz von Bernstorf. Zweifel an Echtheit bleiben" *(The Bernstorf Treasure. Doubts about its authenticity remain)* by H. van Ooijen/C. Stücken. Broadcast 15.02.2017. At 5.47 minutes, Moosauer demonstrates how the 'seal' and the gold could have been embedded in their sand/clay envelopes, <http://www.br.de/mediathek/video/sendungen/kontrovers/bernstorf-schatz-echtheit-faelschung-102.html> (16.02.2017).

ously unknown inscriptions/sequences of symbols in Linear B; *b* knowledge of the iconography of Mycenaean cult images; *c* knowledge of pictographic style of Mycenaean depictions. Answers: *a* The symbols of Linear B script have been known for decades and would not have been difficult to find. Selecting a few symmetrical examples and arranging them in a random order would result in both a previously unknown inscription and unknown sequence of symbols[199]; *b* and *c* For many decades there has been a wide range of popular (and specialist) books available with images of objects from the Mycenaean world. *3* (Table entries 12 and 14) Surface features and traces of weathering on 'seal' and 'face'. *a* Intentional aging on the microscopic level; *b* specialist knowledge of fluorescence of processed amber. Answers: *a* The surface of the 'seal' is not aged or weathered. In fact, Gebhard has been arguing quite the reverse, that it is 'werkfrisch' *(work-fresh)* and has formulated hypotheses about how this occurred. The engraving on the 'face' was cut through an already weathered surface. The supposed weathered (powdered) amber in the surface crazing has been shown to be either: *i* non-existent (Hochleitner/Rewitzer 2016) or *ii* physically incompatible with how amber naturally weathers; *b* fluorescence. This is one of the characteristics which Gebhard/Krause believe to be unforgeable, however, that is because they choose to argue that it is weathered amber that fluoresces and (although they cite Ganzelewski's passage on this topic – see above) ignore the fact that it is, instead, freshly worked or damaged amber which shines under UV light. The 2002 and more recent tests on the 'seal' and the 'face' show clear fluorescence in the engraved lines, the surfaces and inside the perforation; therefore they are freshly worked. The improved storage conditions provided by the ASM have helped to ensure that this effect is still observable. A forger, then, would have had to do nothing, as this tell-tale sign is still in place.

The contention is that a forger would have had to produce a 'perfect forgery'[200], but the above shows that the 'seal' and the 'face' are not perfect forgeries. Indeed, it is unlikely that anyone could produce the 'perfect' forgery, and it is not necessary to do so. Speaking in the most general terms, any stage magician might suggest that all you need to do to help people buy into a particular narrative is to create a situation where they are eager to believe what they are told and, to assist with this, it is advantageous to foster an atmosphere full of anticipation, excitement and unfolding discovery.

Gebhard and Krause state that in their opinion the "only 'suspects'" in the Bernstorf case are "the two persons who discovered the objects" because, they say, only they had both motive and opportunity[201]. The present author makes no comment on their conclusion.

8 Conclusions on the Authenticity of the Amber from Bernstorf

The gold and amber found at Bernstorf have been the subject of much debate as to their authenticity. Those most closely involved in the Bernstorf project have generally been in favour of an 'authentic' verdict, while many others have been more sceptical. At the present time, it seems unlikely that those on either side of the debate will manage to convince

199 Gebhard/Krause (2016, 51 with footnote 130; 128; 143–144) later report that Richard Janko's linguistic studies (Janko/Arbor 2015) have enabled the 'seal's inscription to be read and thus to be dated. Janko's extensive explanations are, however, irrelevant if these objects are forgeries.

200 Gebhard/Krause 2016, 148–149.

201 Gebhard/Krause 2016, 151.

the other of their case. When the author asked for permission to research the amber at the ASM in October 2014, it was not with a predetermined assumption that the amber was either genuine or a forgery. Rather the intention was to let the amber speak for itself. While having carefully considered the arguments put by the lead authors of the 2016 volume and their supporters, the investigations by the author presented above lead her to the clear conclusion that none of the amber was deposited at Bernstorf during the Bronze Age, but was placed there by a person or persons unknown in the much more recent past. There are four principle (but not sole) factors to this conclusion: *1* the extreme freshness, translucency, light-yellow colour and unweathered state of the 'seal' now and when it was released from its sand/clay envelope – a combination of characteristics only seen on newly-worked amber, unless stored in waterlogged conditions, which is not the case at Bernstorf; *2* the sharp edges of the engraved lines and fine tool marks seen in both pieces, especially on the 'seal' – which are not to be expected given the prevailing ground conditions at Bernstorf; *3* the completely unweathered condition of some surfaces of B01, B09 and B13 – for the same reasons; *4* the clear fluorescence exhibited by both the 'face' and the 'seal' – a tell-tale sign that they have been recently worked. Taken together with the fact that there is no archaeological evidence to attribute any of the amber objects to Bronze Age contexts, the author finds these results compelling and especially as amongst all the evidence put forward by those who consider the amber to be genuine, there is not a single, ultimately non-hypothetical argument supporting the assumption that we are dealing with amber objects which have their origin in the Bronze Age.

Summary

The focus of this report and catalogue is the amber discovered at Bernstorf, Freising district between 1997 and 2005. 56 pieces of amber were recovered over a period of nine years. Of these, 50 were studied by the author in October 2014 at the Archäologische Staatssammlung (State Archaeological Collection) in Munich (ASM). The amber and gold finds have been attributed to the Bronze Age, but strong differences of opinion still remain about their authenticity. The rather disparate publication history of the site and its finds has made it difficult for those not intimately involved to build a coherent picture of the situation. The aim of this current paper is to contribute to the debate and, for the first time, to present and discuss the amber assemblage as a whole by building on the additional, but still incomplete, information about the amber which was provided in the recent publication of a collected volume about the archaeology of, and archaeological investigations at Bernstorf. This provides an opportunity to review interpretations and research on the amber which have been ongoing over twenty years.

This report begins with a brief introduction to the history of archaeological activity on the site. Amber as a material is introduced and its various characteristics described. Next, the amber from Bernstorf is examined in more detail. For the first time a chronological listing of all the amber and gold finds is published. A discussion follows about the amber and the various analyses and interpretations over the years. New evidence and interpretations proposed in the 2016 Bernstorf volume are critically assessed. Although this report touches on where the Bernstorf amber would fit into a wider European Bronze Age context, a full discussion of this is not included. On the basis of the physical condi-

tion of some of the amber, the author's conclusion is that the amber found at Bernstorf was not placed there during the Bronze Age, but in more recent times. The report concludes with a catalogue of the amber pieces.

Zusammenfassung

Bericht und Katalog der Bernsteinfunde von Bernstorf, Gde. Kranzberg, Lkr. Freising, Bayern, Deutschland

Im Mittelpunkt dieses Beitrages sowie des zugehörigen Kataloges stehen die Bernsteinfunde, welche in Bernstorf, Lkr. Freising, zwischen 1997 und 2005 entdeckt worden sind. Insgesamt wurden 56 Bernsteinstücke innerhalb eines Zeitraumes von neun Jahren geborgen. Im Oktober 2014 konnte Verfasserin 50 davon in der Archäologischen Staatssammlung in München (ASM) persönlich in Augenschein nehmen und untersuchen. Die Gold- und Bernsteinfunde wurden zwar der Bronzezeit zugeordnet, es bestehen aber weiterhin große Meinungsverschiedenheiten bezüglich ihrer Echtheit. Durch die unzusammenhängende Publikationsgeschichte zur Fundstelle sowie zu ihren Funden und Befunden war es für Unbeteiligte schwierig, ein zusammenhängendes und schlüssiges Bild zu gewinnen. Ziel der vorliegenden Arbeit ist es, sich an der Debatte zu beteiligen und erstmalig das Bernsteinensemble als Ganzes vorzulegen und zu erörtern. Grundlage hierfür sind die ergänzenden, aber weiterhin unvollständigen Angaben zu den Bernsteinen, welche in dem jüngst veröffentlichten Sammelband zur Archäologie von Bernstorf und den vor Ort durchgeführten archäologischen Maßnahmen vorgelegt worden sind. Dies bietet die Möglichkeit, Interpretationen und Untersuchungen zu den Bernsteinen zu überprüfen, die seit etwa 20 Jahren im Raum stehen.

Der vorliegende Beitrag beginnt mit einer kurzen Einführung zur Geschichte der archäologischen Aktivitäten an besagter Fundstelle. Das Material Bernstein wird vorgestellt und seine unterschiedlichen Eigenschaften beschrieben. Anschließend erfolgt eine genauere Untersuchung der Bernsteinfunde von Bernstorf. Zum ersten Mal wird dabei eine chronologische Auflistung aller Gold- und Bernsteinfunde vorgelegt. Hierauf folgt eine Diskussion über die Bernsteinfunde sowie der mannigfaltigen Untersuchungen und Ausdeutungen über viele Jahre hinweg. Neue Ergebnisse und Interpretationen werden in dem 2016 vorgelegten Sammelband über die Funde von Bernstorf kritisch hinterfragt. Obwohl dieser Beitrag sich auch damit auseinandersetzt, auf welche Weise sich die Bernstorfer Bernsteinfunde in den Gesamtkontext der europäischen Bronzezeit einfügen lassen, wurde auf eine ausführliche Diskussion hierüber verzichtet. Aufgrund von Beschaffenheit und Zustand einiger Bernsteine kommt die Verfasserin zu dem Schluss, dass der in Bernstorf gefundene Bernstein nicht während der Bronzezeit, sondern in jüngerer Zeit dort niedergelegt worden ist. Der Beitrag schließt mit einem Katalog der Bernsteinstücke.

Catalogue

There are 56 amber pieces reported as being found at Bernstorf[202], 50 of which were seen by the author at the ASM in October 2014. Where several small, unworked pieces were catalogued, stored and presented together at the ASM, they are listed here under a single entry. The remaining six pieces were not available for research at that time[203]. As five of these are reported as 'small, unworked pieces' and found at some distance from the excavation area[204] these are unlikely to add anything pertinent to the debate. The author has not seen the remaining sixth piece.

The catalogue lists the items in the order of date in which they were found, according to the documentation which exists about them (see Table 1). While the original excavation and museum documentation is ordered in a variety of formats, this catalogue attempts to present these in a standard format. This has sometimes led to a slightly inelegant ordering of some information when compared to the original documents, but this standard presentation does help to give an overview of what was found when, where and by whom. The information comes from the various publications listed within the catalogue entries themselves, from the record cards at the ASM and from information published in the 2016 Bernstorf volume.

Table 1 lists both the amber and gold finds in the chronological order in which they were found. While various authors have published tables showing such details for either the gold or the amber finds[205] or a sub-section of them[206], a full table of both sets of finds has not been presented before. Notwithstanding all of the above, information about the amber finds from Bernstorf remains somewhat confused. This can be seen in some of the entries on Table 1 where conflicting and/or alternative finds numbers and finds dates have been given by different authors (and sometimes by the same author). Some finds have been assigned new catalogue numbers by the ASM and this is noted in Table 1. It is hoped that the forthcoming publication of Bähr's PhD research[207], which deals with the excavations and finds from Bernstorf, will help to clarify the situation further.

As there is no accepted scale to denote the degree of weathering on amber, the catalogue entries refer to this by the subjective terms 'light', 'medium', 'heavy'. There are, of course, gradations between these states, so not all pieces labelled as 'medium-weathered' will look the same.

Note: Various authors in the 2016 Bernstorf volume refer to the catalogue numbers as they were originally designated in the author's draft report, i e. 'BA01', etc. In the present, enlarged report, the catalogue numbers have been changed so what was 'BA01' is now 'B01'. The actual numbering remains the same. An amber find from '1995' referred to by Bähr[208], may be a transcription error of '1998' as no author, including Moosauer/Bachmaier in their 2005 publication, mentions an amber find in 1995.

202 Gebhard/Krause 2016, 53; Bähr 2016, 272–273 Tab. 1. There was also a small yellow pebble (found with B02b) which Bähr concludes is a piece of gravel and is not counted in this total.

203 The five pieces in B02a were not available at that time. Bähr 2016, 272–273 Tab. 1 also shows a third piece of amber with ASM Inv. No. 197, but this was not shown to the author during her study visit in October 2014.

204 Bähr 2016, 267 Fig. 1; 272–273 Tab. 1.

205 Bähr 2016, 272–273 Tab. 1; Gebhard/Krause 2016, 58 Tab. 3.

206 Rohde 2016, 287 Tab. 1.

207 Gebhard/Krause 2016, 45.

208 Bähr et al. 2012, 7 with footnote 4.

Chronological table (Tab. 1) of the amber and gold finds from Bernstorf

Cat. No. (amber)	Inv. No.	Find Date (Finds Label)	Find Date (Bähr 2016)	Find(s)
B01	"Leiten # 936" (Plot # 936)	27.05.1997	27.05.1997	1 piece amber, unworked
B02a	"Stray finds Bachmaier, July 1998"	ASM Oct. 2014, label "Stray finds. Bachmaier Nov./Dec. 2000"	July 1998	5 small amber pieces, unworked (Bähr 2016, 272 Tab. 1)
B02b	"Stray finds July 1998" (Bähr 2016)	-	-	*i* 20 small amber pieces, unworked (Gebhard/Rieder 2002, 127) *ii* 26 small amber pieces & splitters, plus 1 pebble (Bähr 2016)
-	a *1998/28 (Gebhard/Krause 2016, 58 Tab. 3);* b *1998/28 a–f / ASM 2002, 4 a–f (Gebhard/Krause 2016, 65)*	*07. and 09.08.1998*	-	a *7 gold strips (Gebhard/Krause 2016, 58 Tab. 3);* b *6 gold strips (Gebhard/Krause 2016, 65)*
-	*1998/28g / ASM 2009.9a (Gebhard/Krause 2016, 67)*	*15.08.1998*	-	*rolled gold foil and fragment*
-	a *1998/29 (Gebhard/Krause 2016, 58 Tab. 3);* b *1998/29 a–b / ASM 2002.5 and 2002.6a–g (Gebhard/ Krause 2016, 66)*	*16.08.1998*	-	*2 diadem pieces, 7 pendants*
-	a *1998/38a–b (Gebhard/ Krause 2016, 58 Tab. 3);* b *1998/38a–b, 2002.7 & 8 (Gebhard/Krause 2016, 66–67)*	*21.08.1998 (Gebhard/ Krause 2016, 58 Tab. 3)*	-	*gold strips and gold foil*
-	a *1998/38a–b (from 28.09.1998) [sic] (Gebhard/ Krause 2016, 58 Tab. 3);* b i *1998/39a* ii *ASM 2002.11 (Gebhard/Krause 2016, 67–68)*	*26.09.1998 (Gebhard/ Krause 2016, 58 Tab. 3)*	-	i *gold foil wound around wooden shaft;* ii *earlier in day, gold foil found by Moosauer (Gebhard/Krause 2016, 58 Tab. 3)*

Find Location (after Bähr 2016)	Signs of Burning	Finder
Excavation 1994–1997, Area 271, erosion layer	-	Moosauer/Bachmaier (Bähr 2016, 272 Tab. 1)
Stray finds, "northern side of the southern wall" – 360 m south-west of Area 3 (Bähr 2016, 267 Fig. 1)	?	Bachmaier (Bähr 2016, 272 Tab. 1)
i 100 m west of the gold finds *ii* Stray finds from the cleared area west of gold finds	-	*i* not specified (Gebhard/Rieder 2002, 127) *ii* Bachmaier (Bähr 2016, 272 Tab. 1)
Stray find amongst displaced soil	-	*Moosauer/Bachmaier (Gebhard/Krause 2016, 58 Tab. 3)*
Stray find amongst displaced soil	*Yes*	*Moosauer/Bachmaier/Schubert/Gebhard/ Haas-Gebhard (Gebhard/Krause 2016, 58 Tab. 3)*
Stray find amongst displaced soil	*Yes 2002.5; 2002. 6a–g (Gebhard/ Krause 2016, 66)*	*M. Moosauer/I. Moosauer (Gebhard/Krause 2016, 58 Tab. 3)*
Stray find amongst displaced soil	*Yes 2002.7; 2002.8 (Gebhard/ Krause 2016, 66–67)*	*Pietsch/Gebhard/Dr. Steffgen/Währer/ Uenze/Thomas/ Braun/Buchner/ Moosauer/ Bachmaier/Schubert/Gebhard/Haas-Gebhard (Gebhard/Krause 2016, 58 Tab. 3)*
Stray find amongst displaced soil	-	i *Gebhard/Haas-Gebhard;* ii *Moosauer (Gebhard/Krause 2016, 58 Tab. 3)*

Cat. No. (amber)	Inv. No.	Find Date (Finds Label)	Find Date (Bähr 2016)	Find(s)
B03	*i* E. Nr. 1998/40c; *ii* 2002,12c (Bähr 2016, 272 Tab. 1); *iii* 2002,12a (Gebhard/Krause 2016, 71 Fig. 33)	30.09.1998	30.09.1998	1 piece amber, perforated
-	a *1998/40 a and b (Gebhard/Krause 2016, 58 Tab. 3);* b i *ASM 2002.9c,* ii *ASM 2002.10 (Gebhard/Krause 2016, 67–68)*	*30.09.1998*	-	i *spirally-wound gold foil;* ii *gold "Ruderkopfnadel/rudder-headed pin"*
B04	*i* E. Nr. 1999/17a; *ii* not identified (Bähr 2016, 272 Tab. 1); *iii* 2002,12f (Gebhard/Krause 2016, 71 Fig. 33)	30.04.1999	29.04.1999	1 piece amber, perforated
B05	*i* E. Nr. 1999/17b; *ii* not identified (Bähr 2016, 272 Tab. 1); *iii* 2002,12e (Gebhard/Krause 2016, 71 Fig. 33)	30.04.1999	29.04.1999	1 piece amber, perforated
B06	*i* E. Nr. 1999/17c; *ii* not identified (Bähr 2016, 272 Tab. 1); *iii* 2002,12d (Gebhard/Krause 2016, 71 Fig. 33)	30.04.1999	30.04.1999	1 piece amber, perforated
B07	*i* E. Nr. 1999/17d; *ii* not identified (Bähr 2016, 272 Tab. 1); *iii* 2002,12c *[sic]* (Gebhard/Krause 2016, 71 Fig. 33)	30.04.1999	30.04.1999	1 piece amber, perforated
B08	*i* E. Nr. 1999/17e; *ii* not identified (Bähr 2016, 272 Tab. 1); *iii* 2002,12b (Gebhard/Krause 2016, 71 Fig. 33)	30.04.1999	30.04.1999	1 piece amber, perforated
B09	169/2000	11.11.2000	11.11.2000	1 piece amber, unworked, (broken into 2 pieces)
B10	*i* 2004/344 (ASM Oct. 2014); *ii* Object A, E. Nr. 2000/106 (Bähr 2016, 272 Tab. 1)	11.11.2000	11.11.2000	1 piece amber, worked engraved with a face on front and 3 signs/symbols on rear

Find Location (after Bähr 2016)	Signs of Burning	Finder
Stray find amongst displaced soil near the gold finds (Bähr 2016, 267 Fig. 1)	Yes	Moosauer/Bachmaier (Gebhard/Krause 2016, 59)
Stray find amongst displaced soil – both encased in a sand/clay envelope	-	*Gebhard/Dr. Steffgen/Wührer/Thomas/ Blumenau/Braun/ Herr Steffgen (Gebhard/ Krause 2016, 58 Tab. 3)*
Stray find amongst displaced soil near the gold finds (Bähr 2016, 267 Fig. 1)	Yes	Gebhard/Dr. Steffgen/Thomas/Braun (Gebhard/Krause 2016, 58 Tab. 3)
Stray find amongst displaced soil near the gold finds (Bähr 2016, 267 Fig. 1)	Yes	Gebhard/Dr. Steffgen/Thomas/Braun (Gebhard/Krause 2016, 58 Tab. 3)
Stray find amongst displaced soil near the gold finds (Bähr 2016, 267 Fig. 1)	Yes	Gebhard/Dr. Steffgen/Thomas/Braun (Gebhard/Krause 2016, 58 Tab. 3)
Stray find amongst displaced soil near the gold finds (Bähr 2016, 267 Fig. 1)	Yes	Gebhard/Dr. Steffgen/Thomas/Braun (Gebhard/Krause 2016, 58 Tab. 3)
Stray find amongst displaced soil near the gold finds (Bähr 2016, 267 Fig. 1)	Yes	Gebhard/Dr. Steffgen/Thomas/Braun (Gebhard/Krause 2016, 58 Tab. 3)
Stray find amongst displaced soil, Area 3	Yes	Moosauer/Bachmaier (Bähr 2016, 272 Tab. 1)
Stray find amongst displaced soil, Area 3	Yes	Moosauer/Bachmaier (Bähr 2016, 272 Tab. 1)

Cat. No. (amber)	Inv. No.	Find Date (Finds Label)	Find Date (Bähr 2016)	Find(s)
B11	*i* 2004/345 (ASM Oct. 2014); *ii* Object B, E. Nr. 2000/106 *[sic]* (Bähr 2016, 273 Tab. 1)	18.11.2000	18.11.2000	1 piece amber, worked in the form of a seal with 4 signs/symbols on front
B12	*i* Stray find, Bernstorf (ASM Oct. 2014); *ii* Stray finds Bachmaier Nov./Dec. 2000 (Bähr 2016, 272 Tab. 1)	Nov./Dec. 2000	Nov./Dec. 2000	*i* In 1 bag, 2 smaller bags with small unworked pieces amber *a* 27 pieces, *b* 6 pieces (ASM Oct. 2014); *ii* 6 small pieces amber, unworked (Bähr 2016, 272 Tab. 1)
B13	195/2000	13.12.2000	09.12.2000	1 piece amber, unworked
B14	197/2000 (a)	13.12.2000	12.12.2000	1 piece amber, unworked
B15	197/2000 (b)	13.12.2000	12.12.2000	1 piece amber, unworked
B16	219/2001 (a)	25.04.2001	25.04.2001	1 piece amber, unworked
B17	219/2001 (b)	25.04.2001	25.04.2001	1 piece amber, unworked
B18	230/2001	25.05.2001	29.05.2001	1 piece amber, unworked
B19	611/2002	09.10.2002	*i* 09.10.2002 (Bähr 2016, 273 Tab. 1); *ii* 08.10.2002 (Rohde 2016, 287 Tab. 1)	1 piece amber, unworked
B20	44776 E / F85	24.08.2005	*i* 29.08.2005 (Bähr 2016, 273 Tab. 1); *ii* 24.08.2005 (Rohde 2016, 287 Tab. 1)	1 piece amber, unworked

Find Location (after Bähr 2016)	Signs of Burning	Finder
Stray find amongst displaced soil, Area 3 – encased in a sand/clay envelope	Yes	Moosauer/Bachmaier (Bähr 2016, 273 Tab. 1)
Stray finds, no further details on location given	-	Bachmaier (Bähr 2016, 272 Tab. 1)
Stray find amongst displaced soil, Area 3	Yes	Moosauer/Bachmaier (Bähr 2016, 273 Tab. 1)
Stray find amongst displaced soil, Area 3	-	Moosauer/Bachmaier (Bähr 2016, 273 Tab. 1)
Stray find amongst displaced soil, Area 3	-	Moosauer/Bachmaier (Bähr 2016, 273 Tab. 1)
Stray find amongst displaced soil, Area 3	-	Bachmaier (Bähr 2016, 273 Tab. 1)
Stray find amongst displaced soil, Area 3	-	Bachmaier (Bähr 2016, 273 Tab. 1)
Stray find amongst displaced soil, Area 3	No	Bachmaier (Bähr 2016, 273 Tab. 1)
i From Planum 6 in Area/ 6/2002. Layer NOPQ/02,. (Bähr 2016, 272 Tab. 1); *ii* in wheelbarrow load of material [from above location] (Rohde 2016, 287 Tab. 1)	No	T. Lup, SAM worker from the excavation unit (Bähr 2016, 273, Tab. 1)
Area 6/05, southern ramparts, outside Bronze Age fortification	No	G. Mittermaier (volunteer helper) (Bähr 2016, 273 Tab. 1; see also Rohde 2016, 285 with footnote 103).

Catalogue No. B01 - Unworked piece of amber (Fig. 26a–f)

Ref. No. „Leiten # 936“ (Plot #936)

Date found; Found by 27.05.1997 (Tuesday); Moosauer/Bachmaier

Context *a* „Fl. 271. Y 7,60 m; X- 1,20 m; 0,70 m tief + 0,30 m Ackerhorizont“ *(Area 271, Y: 7.60 m; X-: 1.20 m. 0.70 m deep plus 0.30 m below the plough horizon)* (Moosauer/Bachmaier Finds sheet); *b* „[...] gleich hinter dem Wall in der Nähe des fraglichen Kultpfahles zusammen mit der bereits erwähnten besonders schön verzierten mittelbronzezeitliche[n] Siedlungskeramik geborgen [...] (evtl. Opferdeponierung im Krug).“ *(... recovered just behind the wall in the vicinity of the supposed cult post along with the already mentioned, particularly beautifully decorated Middle Bronze Age settlement ceramics ...(possibly a sacrificial deposit in a pot)).* (Moosauer/Bachmaier 2005, 56–57); *c* „Das [...] Stück wurde in einer hellen Sandschicht direkt oberhalb des gewachsenen Bodens entdeckt. [...] Eine Verbindung mit dem sog. Kultpfahl, einem bis zu 2,10 m unter die heutige Oberfläche reichenden Pfostenloch, das in der benachbarten Fläche dokumentiert wurde, ließ sich nicht nachweisen.“ *(The ... piece was found in a light coloured sand layer directly on the natural ground ... There was no evidence of any connection with the so-called cult post, a vertical posthole of up to 2.10 m below the present surface, which was documented in the adjacent area.)* (Bähr 2016, 268).

Form Irregularly shaped. One smooth surface with several convex planes. Other surfaces heavily fractured.

Condition All surfaces and the main body of the piece have many cracks and fissures passing right through the piece. These cracks and fissures have produced many small defined sections which could easily be detached if knocked. There are many patches of freshly broken or crushed areas with exposed surfaces. Some parts have been glued back together.

Colour The body of the piece is a mid-yellow colour with a few patches of darker tones. There are some areas which are clear and translucent.

Weathering Lightly weathered on the surface only. No weathering in any of the cracks or scratches, despite the very fractured nature of the piece.

Fluorescence Not tested by ASM.

Dimensions c. 50 x 30 x 20 mm

Worked No. Moosauer/Bachmaier (2005, 56) say that this piece has been perforated (see below), but the supposed (albeit reportedly broken) perforation is a natural feature.

Other alterations No

Conservation measures Unknown. Detached pieces have been glued back together.

Other remarks ASM record card “Bernstein, Bernstorf”.

Published Moosauer et al. 1998, 278. – Moosauer/Bachmaier 2005, 56–60; 56 Fig. 80. – Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272–273 Tab. 1. – Rohde 2016, 281 with footnote 58; 283 with footnote 76; 287 Tab. 1; 292 Abdr. 31 ; 293 Abdr. 3.3, 3.4.

Comments In October 2014 this piece was in the care of Vanessa Bähr, M. A., Goethe University, Frankfurt am Main.

Fig. 26a–f Bernstorf, Freising district, Bavaria. B01 - Unworked piece of amber. *a* underside. Note fractured nature of the piece; *b* end a; *c* edge 1; *d* upper side; *e* edge 2; *f* end b.

Catalogue No. B02a - Five unworked pieces of amber

ASM Inv. No.	? None reported in the literature. „Lesefunde Bachmaier Juli 1998“ *(Stray finds Bachmaier July 1998).*
Date found; Found by	July 1998 (actual date not specified); Bachmaier
Context	„Lesefunde, südl. Wall, Nordseite“ *(Stray finds. North side of the southern rampart*) (Bähr 2016, 272–273 Tab. 1).

Fig. 27 Bernstorf, Freising district, Bavaria. B02b - 26 unworked pieces of amber and one small yellow pebble.

Form	Five small pieces of unworked amber.
Condition	Unknown
Colour	Unknown
Weathering	Unknown
Fluorescence	Not known. Not tested by ASM.
Dimensions	Unknown
Worked	No
Other alterations	Unknown
Conservation measures	Unknown
Other remarks	No
Published	Bähr 2016, 267–274; 272–273 Tab. 1.
Comments	These finds were not provided for examination in October 2014. They make up the difference in numbers between the pieces seen by the present author in 2014 and the number of amber pieces from Bernstorf given by Gebhard/Krause (2016, 53). Beyond the general description 'Bernstorf', no context or description of the find circumstances of these pieces is recorded. Therefore there is no archaeological evidence that these pieces can in any way be attributed to prehistoric activity at Bernstorf. The author believes that they should be disregarded from further discussion and interpretation.

Catalogue No. B02b - 26 unworked pieces of amber (and one pebble) (Fig. 27)

ASM Inv. No.	? None reported in the literature. „Lesefunde 1998" *(Stray finds 1998).*
Date found; Found by	1998 (actual date not specified); Bachmaier
Context	Stray finds
Form	„26 kleine Bernsteinstücke und -splitter (+1 kleiner Kieselstein)" [...] „Sie entsprechen den ‚20 kleine[n], unbearbeitete[n] Bernsteinstücke[n]', die bei Gebhard/Rieder (2000) *[sic]* erwähnt werden." *(26 small pieces and chips of amber (+ 1 small pebble) ... these correspond to the "20 small unworked amber pieces" which*

were mentioned by Gebhard/ Rieder 2000 [sic].) (Bähr 2016, 268–269; 272–273 Tab. 1).

Condition Unknown
Colour Unknown
Weathering Unknown
Fluorescence No. Tested by ASM. [Test No. 2] „20 kleine, unbearbeitete Bernsteinstücke, die 1998 in Bernstorf 100 m westlich der Fundstelle des Goldfundes aufgelesen wurden. Keines der Stücke weist Fluoreszenzerscheinungen auf [9.1.2001]" *(20 small, unworked amber pieces, found at Bernstorf in 1998 100 metres west of the findspot of the gold finds. None of the pieces showed any fluorescence [9.1.2001])* (Gebhard/Rieder 2002, 127).
Dimensions Irregularly shaped pieces all ≤ 1 cm in size.
Worked No
Other alterations Unknown
Conservation measures Unknown
Other remarks No
Published Gebhard/Rieder 2002, 127. – Bähr 2016, 267–274; 272–273 Tab. 1.
Comments In October 2014, a bag of small amber pieces was produced for examination. Inside were 27 items, plus a second bag containing six amber pieces. All were under the same find label, a piece of paper reading „Bernstorf, Lkr. Freising. Lesefunde *[Stray finds]*. T. Bachmaier. November/Dezember 2000". Using Table 1 in Bähr, (2016, 272–273), it is possible to say that the 27 pieces belong to her table entry labelled: „Lesefunde 1998 – 26 kleine Bernsteinstücke und -splitter (+1 kleiner Kieselstein)" *(Stray finds 1998 – 26 small pieces and chips of amber (+ 1 small pebble))*– (here B02b). The six pieces in the separate bag must belong to her table entry for „Lesefunde *[Stray finds]*. T. Bachmaier, November/ Dezember 2000." – (here B12). It is probable that Gebhard's '20' was a transcription error of '26'. Beyond the general description 'Bernstorf', no context or description of the find circumstances of these pieces is recorded. Therefore there is no archaeological evidence that these pieces can in any way be attributed to prehistoric activity at Bernstorf. The author believes that they should be disregarded from further discussion and interpretation.

Catalogue No. B03 - Perforated amber object (Fig. 28a–g)

ASM Inv. No. *a* E 1998/40c- ASM Finds Label October 2014; *b* 2002, 12c- Bähr 2016, 272–273 Tab. 1; *c* 2002, 12a- Gebhard/Krause 2016, 71; 71 Fig. 33.
Date found; Found by 30.09.1998 (Wednesday); Moosauer/Bachmaier: „Nach einem Tagebucheintrag von Bachmaier war sie zusammen mit Moosauer am 30.09. auch in Bernstorf (aber offenbar nicht gleichzeitig mit den Fachkollegen) und beide fanden dort einen durchbohrten Bernstein." *(According to a diary entry by Bachmaier, she was at Bernstorf on September 30th and together with Moosauer (but apparently not in the presence of their specialist colleagues) found a piece of perforated amber.)* (Gebhard/Krause 2016, 59).
Context Stray finds amongst disturbed tree roots. Gebhard (1999b, 2 Fig. 1) shows the findspot c. 1 m from the area of the gold

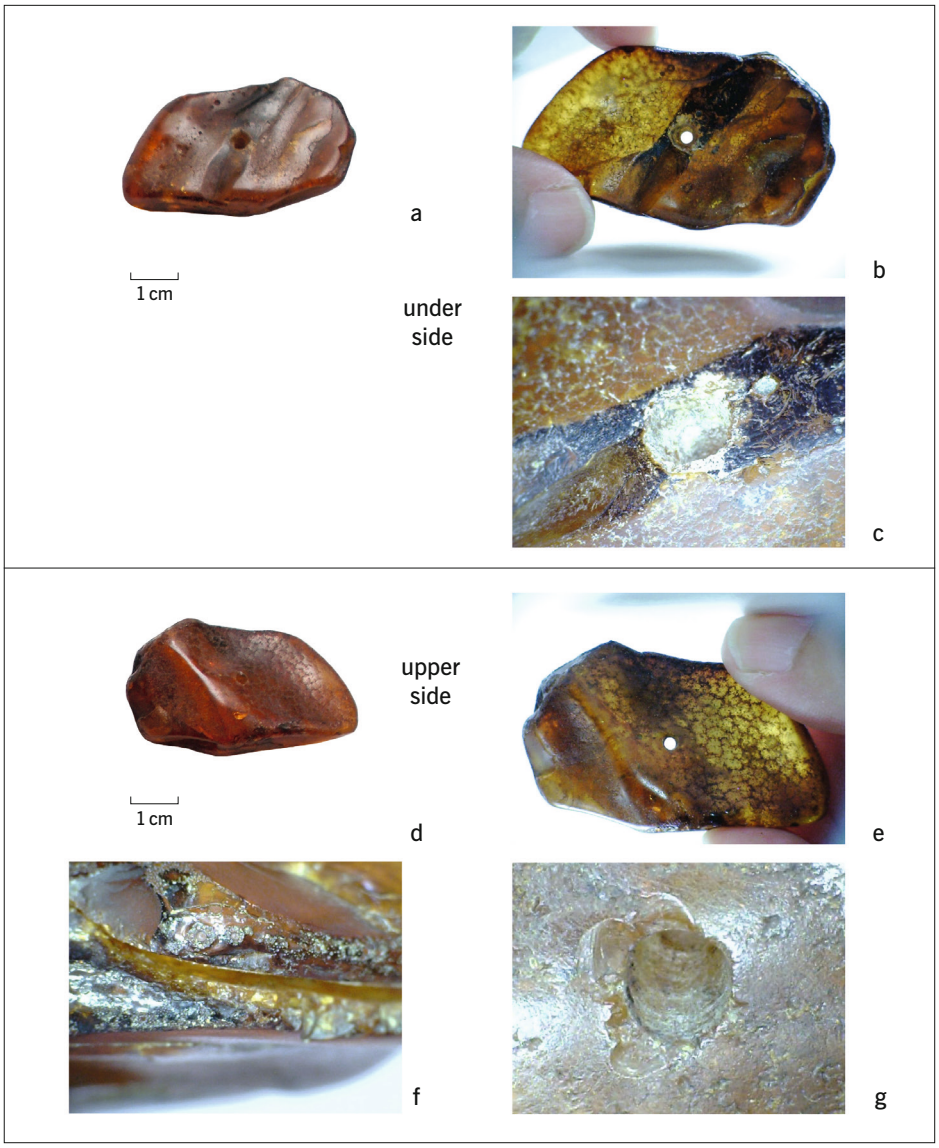

Fig. 28a–g Bernstorf, Freising district, Bavaria. B03 - Perforated amber object. *a–b* underside; *c* underside showing perforation entrance; *d–e* upper side; *f* edge showing sharp-edged 'cut'; *g* upper side showing perforation exit. Note damage around perforation. 28b–c.e–g not to scale.

finds. A gold spiral and a rudder-headed pin were reported as found on the same day. „Sämtliche Fundstücke befanden sich in sekundärer Lage

(Abb. 1) im humosen Erdreich zwischen den zuunterst liegenden Baumstrünken, so daß über den ursprünglichen Befund keine Aussagen mehr

getroffen werden können." *(All the finds were in secondary contexts (Fig. 1) in humus-rich earth, between the lowermost lying tree trunks, so that nothing more can be said about the original context.).*

Form Natural, rhomboid-shaped piece. There is a natural ridge along the upper side. The underside has a natural uneven surface.

Condition Complete. There is a deep, sharp-edged incision along one edge. There are signs of charring around the edges and in a band in a natural channel across the underside which cuts and exposes the lighter coloured interior (Fig. 28f).

Colour Against the light, one end is more yellow, the other is more orange (Fig. 28b).

Weathering There is light weathering in the form of a slightly crazed surface across the whole piece.

Fluorescence Yes. Tested by ASM. [Test No. 1] „Sechs Bernsteinstücke, die 1998 und 1999 zusammen mit dem Goldfund in Bernstorf geborgen wurden. Die Stücke weisen partiell schwache Fluoreszenzerscheinungen an der Oberfläche auf, im Bereich der Bohrungen sind deutliche Fluoreszenzerscheinungen feststellbar [9.1.2001]." *(Six pieces of amber, which were recovered together with the gold finds in 1998 and 1999 at Bernstorf. The pieces have partially weak fluorescence phenomena at the surface, in the region of the perforations distinct fluorescence was detected [9.1.2001])* (Gebhard/Rieder 2002, 127).

Dimensions 47 x 27 x 12 mm

Worked The perforation has been bored from the underside to the upper side. It is strongly conical where it enters the piece (Fig. 28b–c) and has broken out on the other side, causing chipping around the hole (Fig. 28g). The perforation cuts through the area of slight charring on the underside. No charring is visible inside the perforation. The sharp-edged cut along one edge also cuts through an area of charring. The edges of this cut are fresh and sharp. They do not have the weathering seen on the rest of the piece, nor are the internal surfaces inside the cut weathered in any way.

Other alterations No

Conservation measures Unknown. In October 2014, Gebhard reported that no conservation measures have been undertaken. In the 2016 volume it is reported that the Bernstorf amber „[...] kontinuierlich im Dunkeln und unter Wasser aufbewahrt [wird]." [has been kept] *(... continually in the dark and submerged in water)* since alterations to the surface caused by the atmospheric conditions in which it had been stored were first noticed (Gebhard/Krause 2016, 124).

Other remarks No

Published Gebhard 1999b, 2 Fig. 1; 8 Fig. 9. – Moosauer/Bachmaier 2005, 66; 98. – Gebhard/Krause 2016, 58 Tab. 3; 59; 65; 70–72; 71 Fig. 33. – Bähr 2016, 267–274; 272–273 Tab. 1.

Comments This is a naturally-shaped piece of amber. Gebhard (1999b, 8) suggested that this and the other five perforated pieces of amber found close by were originally crafted, rectangular artefacts: „Zum Teil sind noch die geraden Seitenkanten erhalten, was den Schluß zuläßt, daß die Stücke ursprünglich wohl alle von annähernd recht-

eckiger Form waren." *(Sections of straight sides remain, which allows the conclusion that these pieces were originally approximately rectangular in shape),* but this is not the case. He suggested at that time that they were analogous to the amber spacers found by Wenzl at Asenkofen in 1904/05, but has since concluded (correctly) that these are naturally shaped pieces. The perforation was made after the burning episode.

Catalogue No. B04 - Perforated amber object (Fig. 29a–g)

ASM Inv. No.	*a* E 1999/17a- ASM Finds Label October 2014; *b* 2002, 12f- Gebhard/Krause 2016, 71 Fig. 33.
Date found; Found by	30.04.1999 (Friday); R. Gebhard/U. Steffgen/C. Thomas/F. Braun (Gebhard/Krause 2016, 58 Tab. 3).
Context	Stray finds amongst disturbed tree roots. Found with B05; B06; B07 and B08. Gebhard (1999b, 2 Fig. 1) shows the location as c. 1 m from the findspot of B03.
Form	Naturally-shaped, amorphous piece, with uneven surfaces on both top and bottom sides.
Condition	Complete. Heavily burnt/charred at one end. At one end is a smooth area with a different style of crazing pattern to the remainder of the unburnt surface.
Colour	Where not burnt, mid-brown.
Weathering	Where not burnt, the surface has the typical crazed pattern of medium-weathered amber.
Fluorescence	Yes. Tested by ASM. See the entry for B03.
Dimensions	27 x 21 x 11 mm
Worked	Perforated from the upper side to the underside. The perforation is parallel sided but appears conical at the exit point due to damage to the surface around the hole (Fig. 29d). The perforation has broken through the weathered surface and damaged it. The edges of the entry hole are sharp and unweathered.
Other alterations	No
Conservation measures	Unknown. See entry for B03.
Other remarks	No
Published	Gebhard 1999b, 2; 8; 16; 18; 8 Fig. 9. – Moosauer/Bachmaier 2005, 66 Fig. 98 (image only, not referred to in the text). – Gebhard/Krause 2016, 58 Tab. 3; 59; 65; 70–72; 71 Fig. 33. – Bähr 2016, 267–274; 272–273 Tab. 1.
Comments	This is a naturally-shaped piece of amber - see comments for B03.

Catalogue No. B05 - Perforated amber object (Fig. 30a–f)

ASM Inv. No.	*a* E 1999/17b- ASM Finds Label October 2014; *b* 2002, 12e- Gebhard/Krause 2016, 71 Fig. 33.
Date found; Found by	30.04.1999 (Friday); R. Gebhard/U. Steffgen/C. Thomas/F. Braun (Gebhard/Krause 2016, 58 Tab. 3).
Context	Stray finds amongst disturbed tree roots. Found with B04; B06; B07 and B08. Gebhard (1999b, 2 Fig. 1) shows the location as c. 1 m from the findspot of B03.
Form	Naturally-shaped, amorphous piece. Uneven on both the upper and lower surfaces.
Condition	Complete. Traces of burning at one end and along one edge.
Colour	Against the light, mid orange where not burnt.
Weathering	In the areas which are not burnt, most of the surface has medium weathering. There is also a large area of smooth, polished, completely unweathered surface.

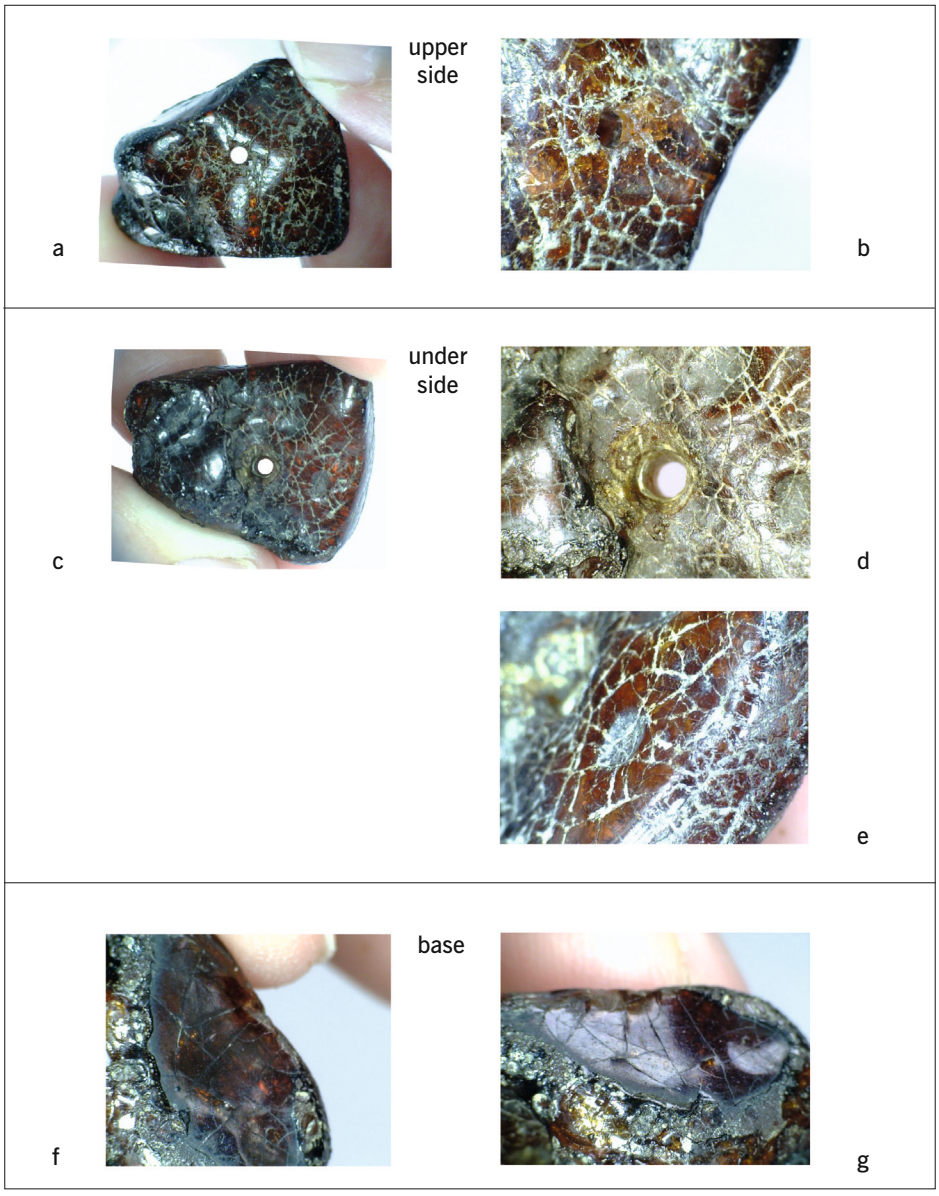

Fig. 29a–g Bernstorf, Freising district, Bavaria. B04 - Perforated amber object. *a–b* upper side; *c* underside; *d* underside showing perforation exit. Note unweathered damage around perforation; *e* underside showing dimple to right of perforation; *f–g* end a showing burning on top of unweathered smooth area. Not to scale.

Fluorescence Yes. Tested by ASM. See the entry for B03.
Dimensions 27 x 20 x 8 mm
Worked Perforated. The perforation is parallel sided, not conical. The interior of the perforation is not fresh, but there is some recent chipping on the

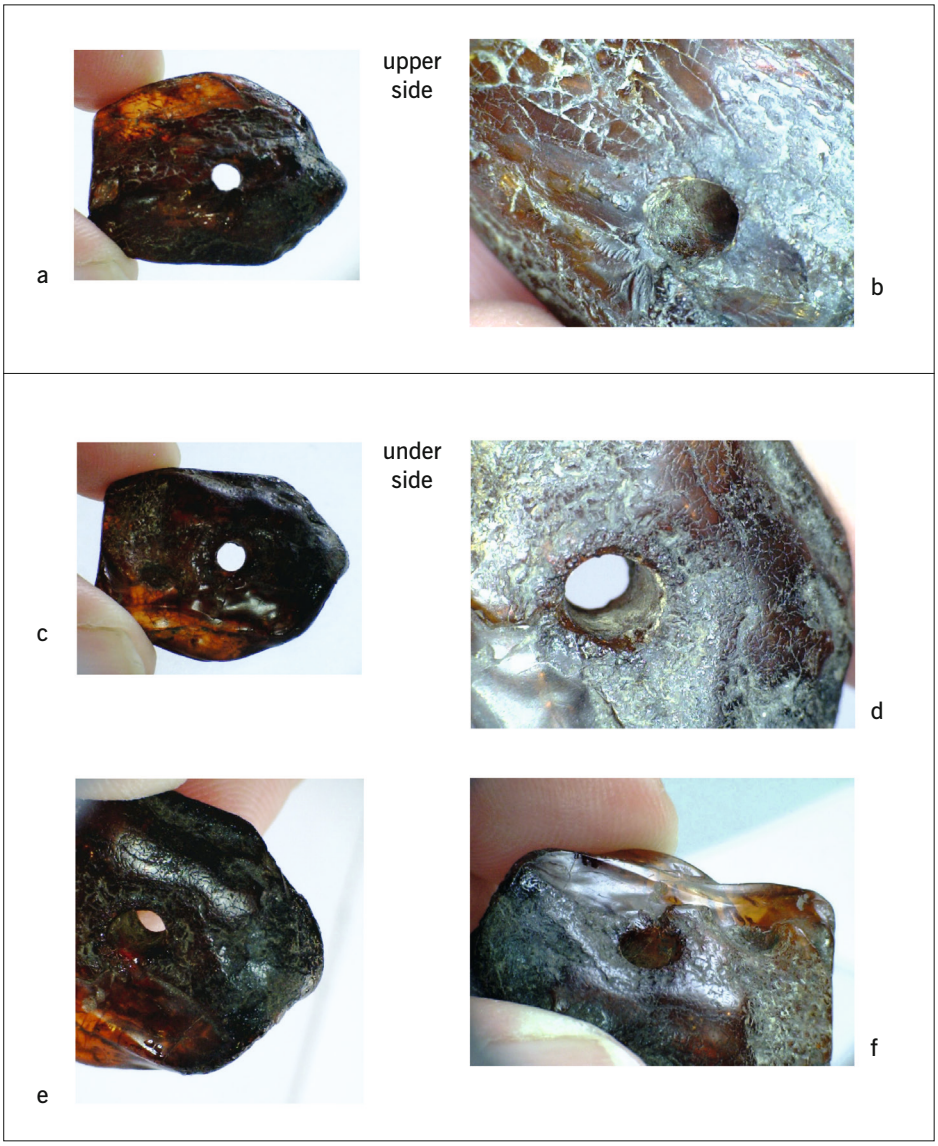

Fig. 30a–f Bernstorf, Freising district, Bavaria. B05 - Perforated amber object. *a–b* upper side; *c–e* underside. Note slight, unweathered damage around perforation. *f* underside. Note the smooth, unweathered, translucent area. Not to scale.

	entrance hole on the underside of the piece (Fig. 30d).
Other alterations	No
Conservation measures	Unknown. See entry for B03.
Other remarks	No
Published	Gebhard 1999b, 16; 18; 2 Fig. 1; 8 Fig. 9. – Moosauer/Bachmaier 2005, 66 Fig. 98 (image only, not referred to in the text). – Gebhard/Krause 2016, 58

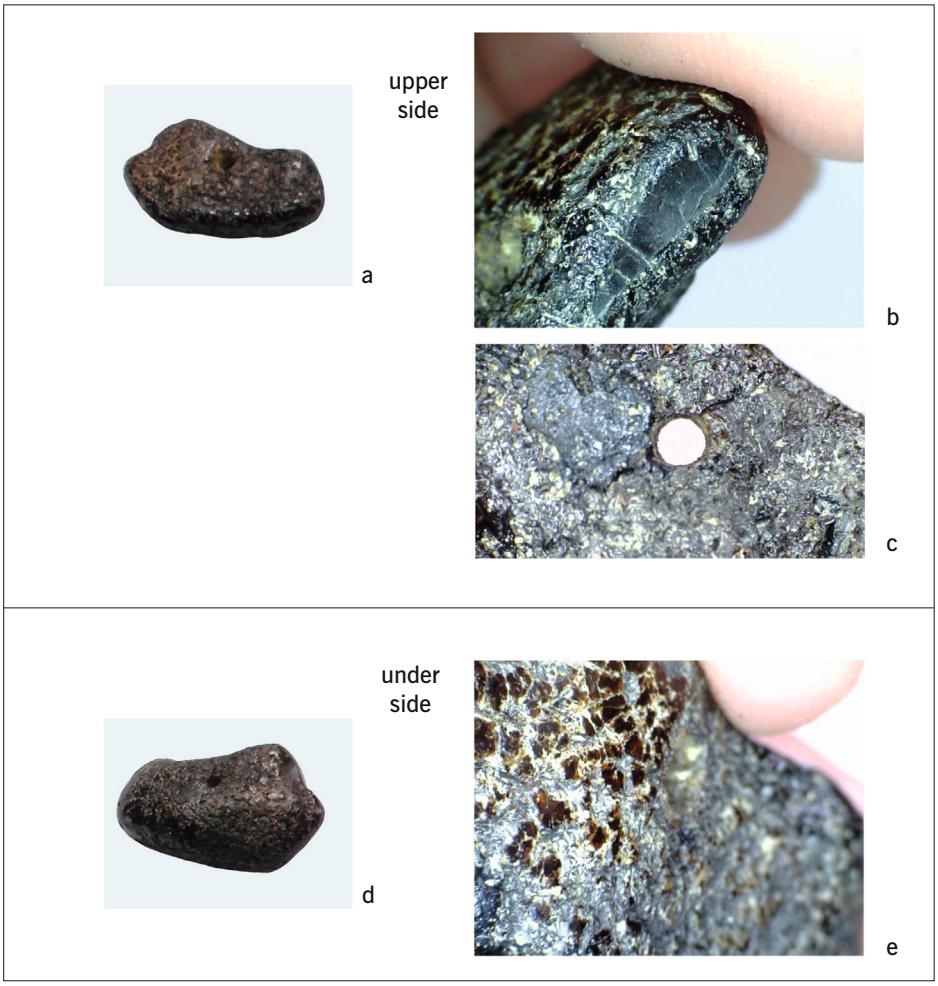

Fig. 31a–e Bernstorf, Freising district, Bavaria. B06 - Perforated amber object. *a* upper side; *b* end a showing smooth area surrounded by traces of burning; *c* upper side showing perforation; *d–e* underside. Not to scale.

Catalogue No. B06 - Perforated amber object (Fig. 31a–e)

ASM Inv. No.	*a* E 1999/17c- ASM Finds Label October 2014; *b* 2002.12d- Gebhard/Krause 2016, 71 Fig. 33.
Date found; Found by	30.04.1999 (Friday); R. Gebhard/U. Steffgen/C. Thomas/F. Braun (Gebhard/Krause 2016, 58 Tab. 3).
Context	Stray finds amongst disturbed Tab. 3; 59; 65; 70–72; 130; 71 Fig. 33, 130 Fig. 86. – Bähr 2016, 267–274; 272–273 Tab. 1.
Comments	This is a naturally-shaped piece of amber - see comments for B03. The burning episode appears to have happened after the perforation was made, however, the fresh chips at the entrance hole have broken into the burnt area, meaning that they occurred more recently.

	tree roots. Found with B04; B05; B07 and B08. Gebhard (1999b, 2; Fig. 1) shows the location as c. 1 m from the findspot of B03.
Form	Naturally-shaped piece. Mainly flat on the upper side and more domed on the underside.
Condition	Complete. Burnt at one end and along one edge.
Colour	Dark red/brown
Weathering	Heavily weathered all over. The high areas of the surface have been polished.
Fluorescence	Yes. Tested by ASM. See the entry for B03.
Dimensions	27 x 16 x 9 mm
Worked	Perforated. The perforation is parallel-sided.
Other alterations	No
Conservation measures	Unknown. See the entry for B03.
Other remarks	No
Published	Gebhard 1999b, 16; 18; 2 Fig.1; 8 Fig. 9. – Moosauer/Bachmaier 2005, 66 Fig. 98. – Gebhard/Krause 2016, 58 Tab. 3; 59; 65; 70–72; 71 Fig. 33. – Bähr 2016, 267–274; 272–273 Tab. 1.
Comments	This is a naturally-shaped piece of amber - see comments for B03.

Catalogue No. B07 - Perforated amber object (Fig. 32a–f)

ASM Inv. No.	*a* E 1999/17d- ASM Finds Label October 2014; *b* 2002.12c- Gebhard/Krause 2016, 71 Fig. 33.
Date found; Found by	30.04.1999 (Friday); R. Gebhard/U. Steffgen/C. Thomas/F. Braun (Gebhard/Krause 2016, 58 Tab. 3).
Context	Stray finds amongst disturbed tree roots. Found with B04; B05; B06 and B08. Gebhard (1999b, 2 Fig. 1) shows the location as c. 1 m from the findspot of B03.
Form	Naturally-shaped piece. Irregular but flattish, rounded form.
Condition	Heavily weathered. There are chips missing around both entrances of the perforation. There is some burning/charring on one side.
Colour	Mid-red/brown
Weathering	Heavily weathered all over.
Fluorescence	Yes. Tested by ASM. See the entry for B03.
Dimensions	25 x 20 x 9 mm
Worked	Perforated. The perforation is parallel-sided.
Other alterations	No
Conservation measures	Unknown. See the entry for B03.
Other remarks	No
Published	Gebhard 1999b, 2 Fig.1; 8 Fig. 9. – Moosauer/Bachmaier 2005, 66 Fig. 98. – Gebhard/Krause 2016, 58 Tab. 3; 59; 65; 70–72; 71 Fig. 33. – Bähr 2016, 267–274; 272–273 Tab. 1.
Comments	This is a naturally-shaped piece of amber - see comments for B03.

Catalogue No. B08 - Perforated amber object (Fig. 33a–f)

ASM Inv. No.	*a* E 1999/17e- ASM Finds Label October 2014; *b* 2002.12b- Gebhard/Krause 2016, 71 Fig. 33, illustration included in Gebhard (1999b, 8 Fig. 9), but only four inventory numbers given for five pieces (E 1999/17a–d).
Date found; Found by	30.04.1999 (Friday); R. Gebhard/U. Steffgen/C. Thomas/F. Braun (Gebhard/Krause 2016, 58 Tab. 3).
Context	Stray finds amongst disturbed tree roots. Found with B04; B05; B06 and B07. Gebhard (1999b, 2 Fig. 1) shows the location as c. 1 m from the findspot of B03.
Form	Naturally-shaped piece. Irregular, flattish, but rounded form with a prominent point at one end.
Condition	Complete. There is an area of burning/charring around one

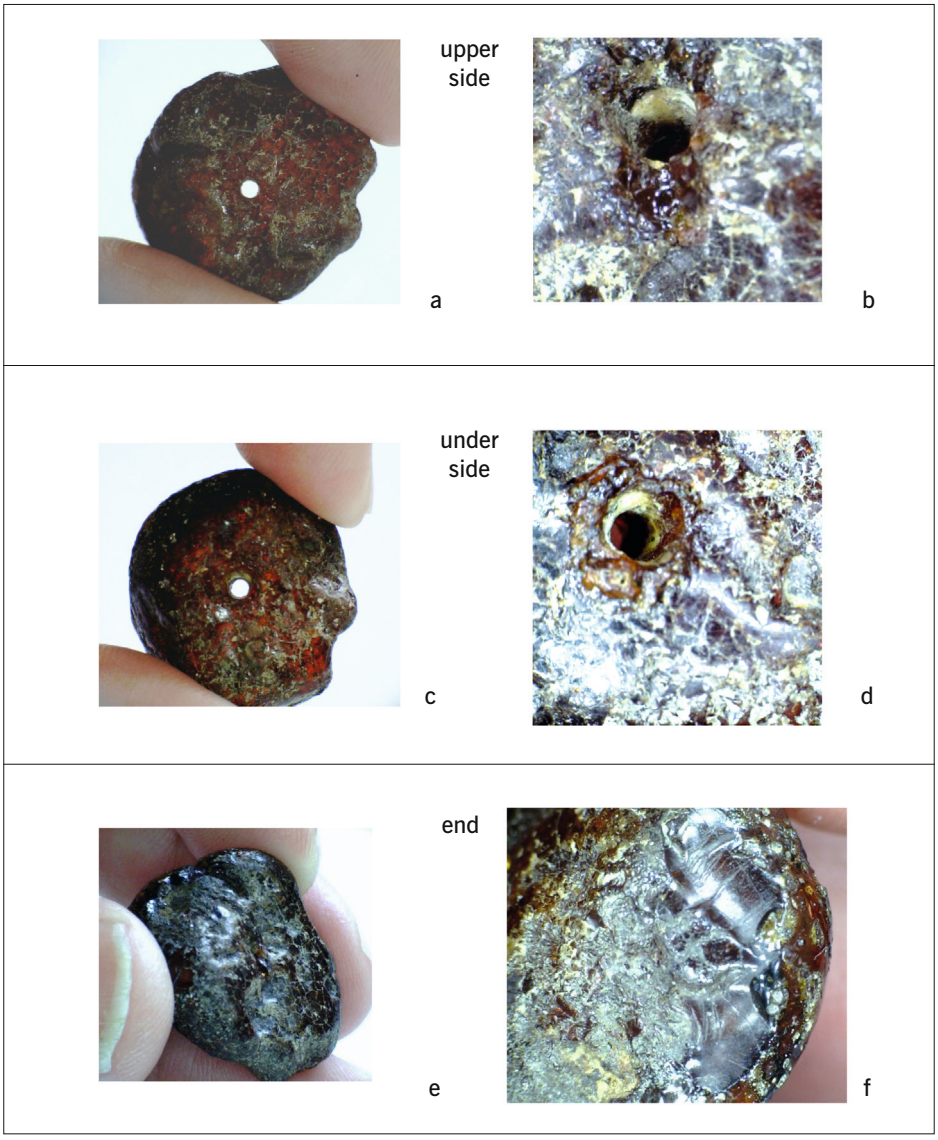

Fig. 32a–f Bernstorf, Freising district, Bavaria. B07 - Perforated amber object. *a* upper side; *b* upper side showing perforation. Note unweathered damage around perforation; *c* underside; *d* underside showing perforation. Note unweathered damage around perforation; *e–f* end a. Not to scale.

edge and the across half of both sides. There is a smooth, flat area along one edge.

Colour Against the light, mid orange where not burnt.

Weathering There is evidence of weathering on both surfaces, however, it is not uniform across the whole piece. The smooth area is completely unweathered.

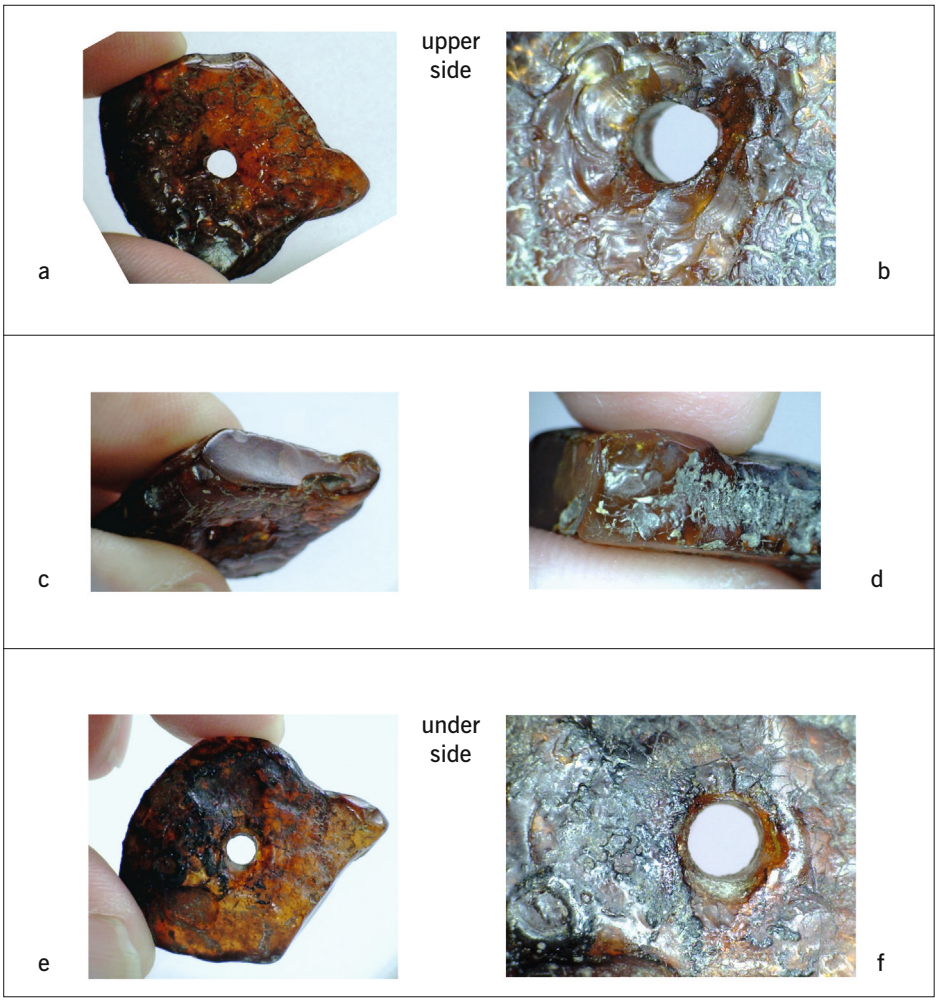

Fig. 33a–f Bernstorf, Freising district, Bavaria. B08 - Perforated amber object. *a* upper side; *b* upper side showing perforation. Note extensive unweathered damage around perforation; *c* end a; *d* edge 1; *e* underside; *f* underside showing perforation. Note traces of burning running up to the perforation but not inside it. Not to scale.

Fluorescence Yes. Tested by ASM. See the entry for B03.
Dimensions 25 x 20 x 8 mm
Worked Perforation. This has been drilled from the upper side to the underside. On the upper side there is considerable damage around the perforation which appears to have been done when the hole was made (Fig. 33b). The damage cuts through and damages the weathering on the main surface of the piece. The drilling damage itself is completely unweathered (Fig. 33b). This damage has circular scar forms, probably caused by the

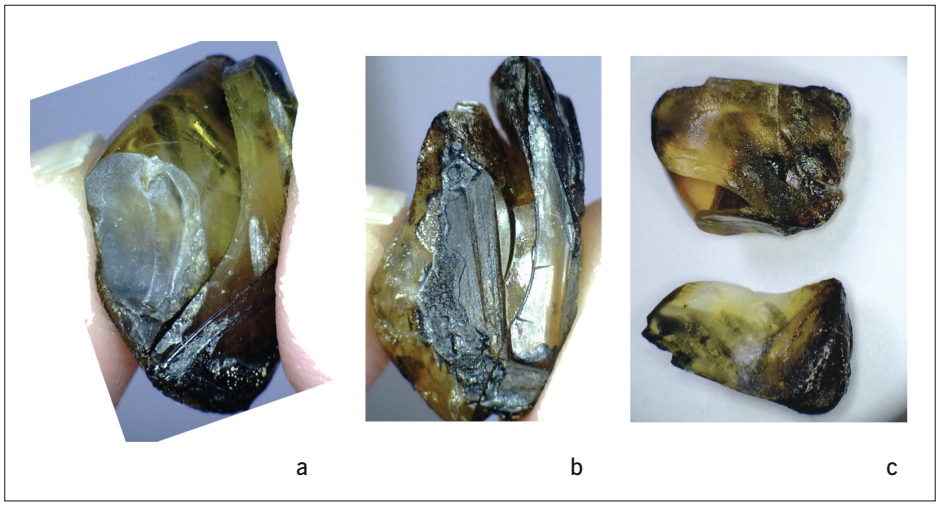

Fig. 34a–c Bernstorf, Freising district, Bavaria. B09 - Unworked piece of amber. Piece broken into two conjoining pieces. *a* edge 1. The two pieces are held together to make the whole; *b* edge 2. Note traces of burning on unweathered surface; *c* the two pieces separated. Note the fresh, unweathered surface of the breaks and the completely unweathered and translucent interior. Not to scale.

	rotation of the drill. There is a slight scar at the perforation on the underside (Fig. 33f).
Other alterations	No
Conservation measures	Unknown. See the entry for B03.
Other remarks	No
Published	Gebhard 1999b, 16; 18; 2 Fig.1; 8 Fig. 9. – Moosauer/Bachmaier 2005, 66 Fig. 98. (image only, not referred to in the text.). – Gebhard/Krause 2016, 64; 70–72; 71 Fig. 33. – Bähr 2016, 267–274; 272–273 Tab. 1.
Comments	This is a naturally-shaped piece of amber - see comments for B03. The area of burning runs right up to the exit hole of the perforation, but does not go inside the hole. However, on the upper side from which the perforation was drilled, there are faint traces of burning on the lip where the external drilling damage meets the perforation proper. This burning does not continue further down the perforation itself, but there is a small amount in the drill scar damage, thus it must have happened after the perforation took place.

Catalogue No. B09 - One unworked piece of amber (Fig. 34a–c)

ASM Inv. No.	169
Date found; Found by	11.11.2000 (Saturday) Gebhard/Rieder 2002, 127 say this was found on the same day as the 'seal' (B11) (18.11.2000), but Bähr 2016, 272–273 Tab. 1 says Find 169/2000 was found on the same day as the 'face' (B10) (11.11.2000); Moosauer/Bachmaier.
Context	Stray find amongst disturbed tree roots. „Lesefund Fläche 3" *(Stray find in Area 3)* - ASM Finds Label.

Form	Amorphous piece
Condition	One small piece broken (along existing fracture line?) into two joining parts. One long edge has a recent break which runs across an area of burning/charring. Burning/charring also observed on one end. Much of the piece is clear and translucent (Fig. 34a–c).
Colour	Translucent, clear piece with dark organic inclusions.
Weathering	Very light weathering only, observed on small area of upper surface. The rest of the surface is completely unweathered.
Fluorescence	Yes. Tested by ASM. [Test No. 3] „Kleines, amorphes Stück, das am 19.11.2000 gleichzeitig mit dem Siegel gefunden wurde. Es weist eine frische Beschädigung auf, die stark fluoresziert. Die unbeschädigte, glatte Oberfläche weist leichte Fluoreszenzerscheinungen auf [2.1.2001].". *(Small, amorphous piece, that was found on 19.11.2000 [sic] at the same time as the seal. There is fresh damage which fluoresces strongly, while the undamaged, smooth surface fluoresces slightly [2.1.2001])* (Gebhard/Rieder 2002, 127).
Dimensions	12 x 10 x 7 mm
Worked	No
Other alterations	No
Conservation measures	Stored in water in a small vial. See entry for B03.
Other remarks	Handwritten on ASM Find Label „Kopie, Originale verschimmelt und vernichtet" *(Copy, original mouldy and destroyed.)*.
Published	Gebhard/Rieder 2002, 127 (fluorescence results only). – Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272–273 Tab. 1.
Comments	The burning/charring is very localised, with the rest of the piece showing no signs of being affected by the heat. The burning runs over the top of the unweathered surface (Fig. 34b), so that the fresh surface cannot be the result of damage caused by earth-moving equipment.

Catalogue No. B10 - Amber 'face' (Fig. 35a–h; Fig. 36a–h; Fig. 37a–h)

ASM Inv. No.	*a* 2004/344 - ASM Finds Label October 2014; *b* 2000/106 - Bähr 2016, 272–273 Tab. 1.
Date found; Found by	11.11.2000 (Saturday); Moosauer/Bachmaier
Context	Stray find amongst disturbed tree roots in Area 3. „[...] etwa 50 m von der Fundstelle des Goldfundes [...]" *(... about 50 m distant from the gold findspot ...)* (Gebhard/Rieder 2002, 121).
Form	Roughly triangular shaped piece.
Condition	Complete. Burning/charring on edges.
Colour	Mid-brown
Weathering	Medium to heavy weathering over most of the surface, however, there is an area on the back which has a smooth surface which is unweathered. See comments below.
Fluorescence	Yes. Tested by ASM. [Gesicht] „Im Bereich der alten, krustig schrundigen Bernsteinoberfläche sind keine Fluoreszenzerscheinungen unter UV-Licht zu beobachten. Die Gravuren setzen sich davon etwas heller ab, im Bereich der glatten, abgeschmolzenen Stellen wirkt die Oberfläche unter UV-Licht wie mit einem sehr schwachen, leicht milchigen Schleier überzogen [schwache Fluoreszenzerscheinung]." *([Face] In the area of the old, crusty wrinkled amber surface, no fluorescence was observed under UV light. In*

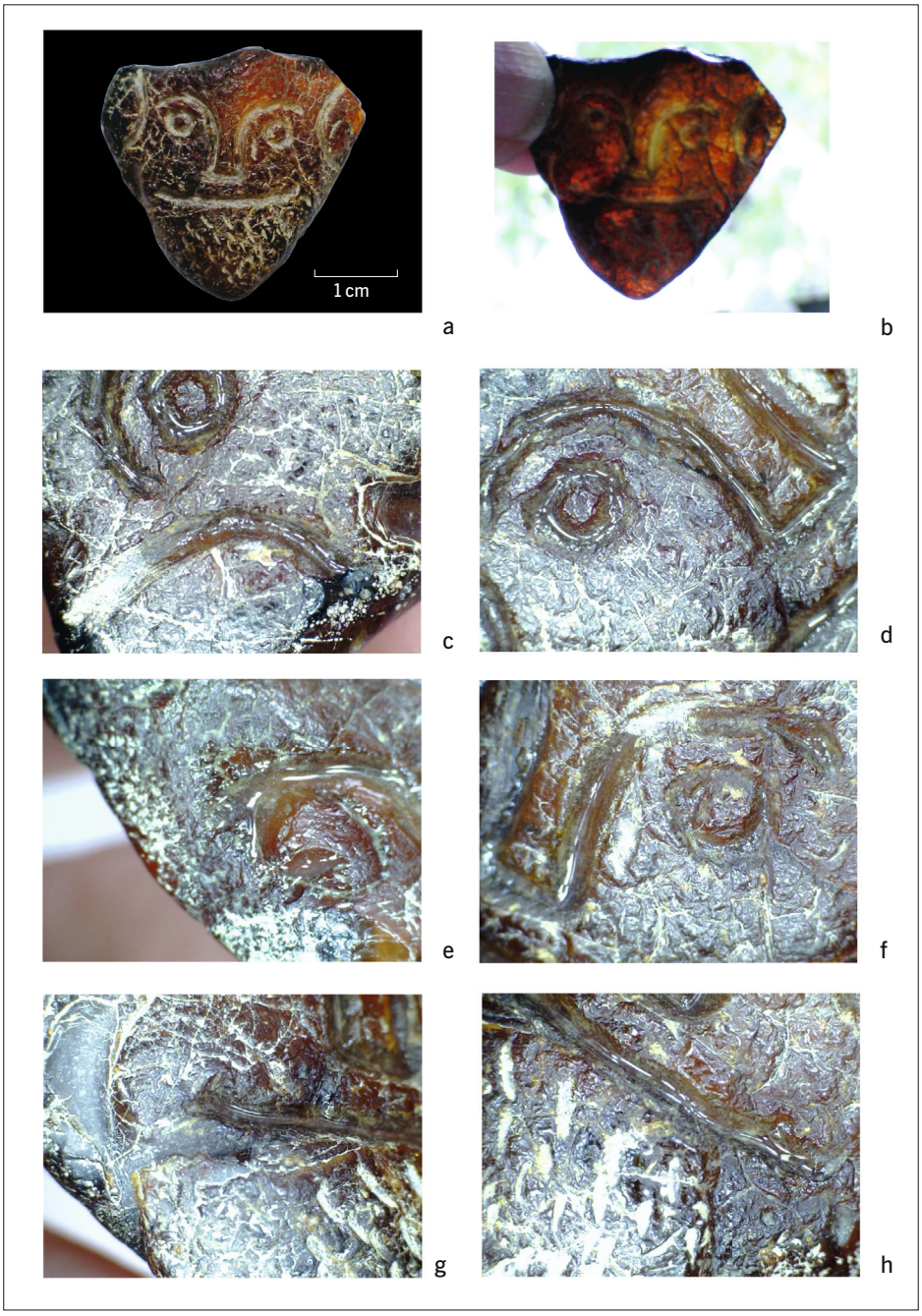

Fig. 35a–h Bernstorf, Freising district, Bavaria. B10 - Amber 'face'. *a* the engraved 'face' side; *b* the 'face' held up to the light. Note the bright appearance; *c* close-up of left ear and left eye (as seen by viewer); *d* left eye and nose; *e* right ear; *f* right eye and nose; *g* left side of mouth and part of beard; *h* right side of mouth and part of beard. Note the 'varnish' in the ear/eye/nose/mouth engravings. 35b–h not to scale.

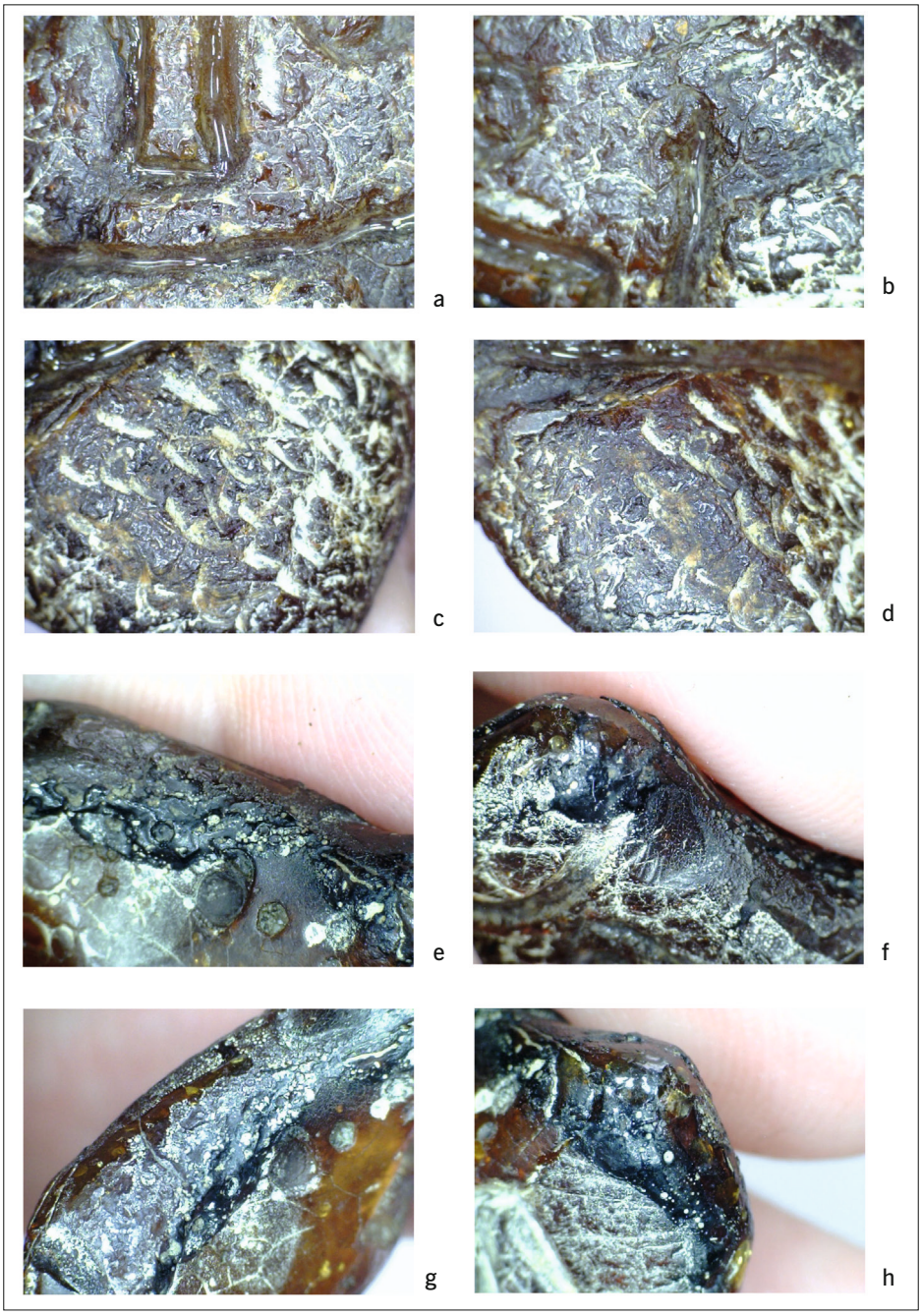

Fig. 36a–h Bernstorf, Freising district, Bavaria. B10 - Amber 'face'. *a* nose and mouth; *b* right end of mouth; *c–d* beard engravings; *e–h* traces of burning on edge of piece. Note how the burning is next to smooth, undamaged surface. Not to scale.

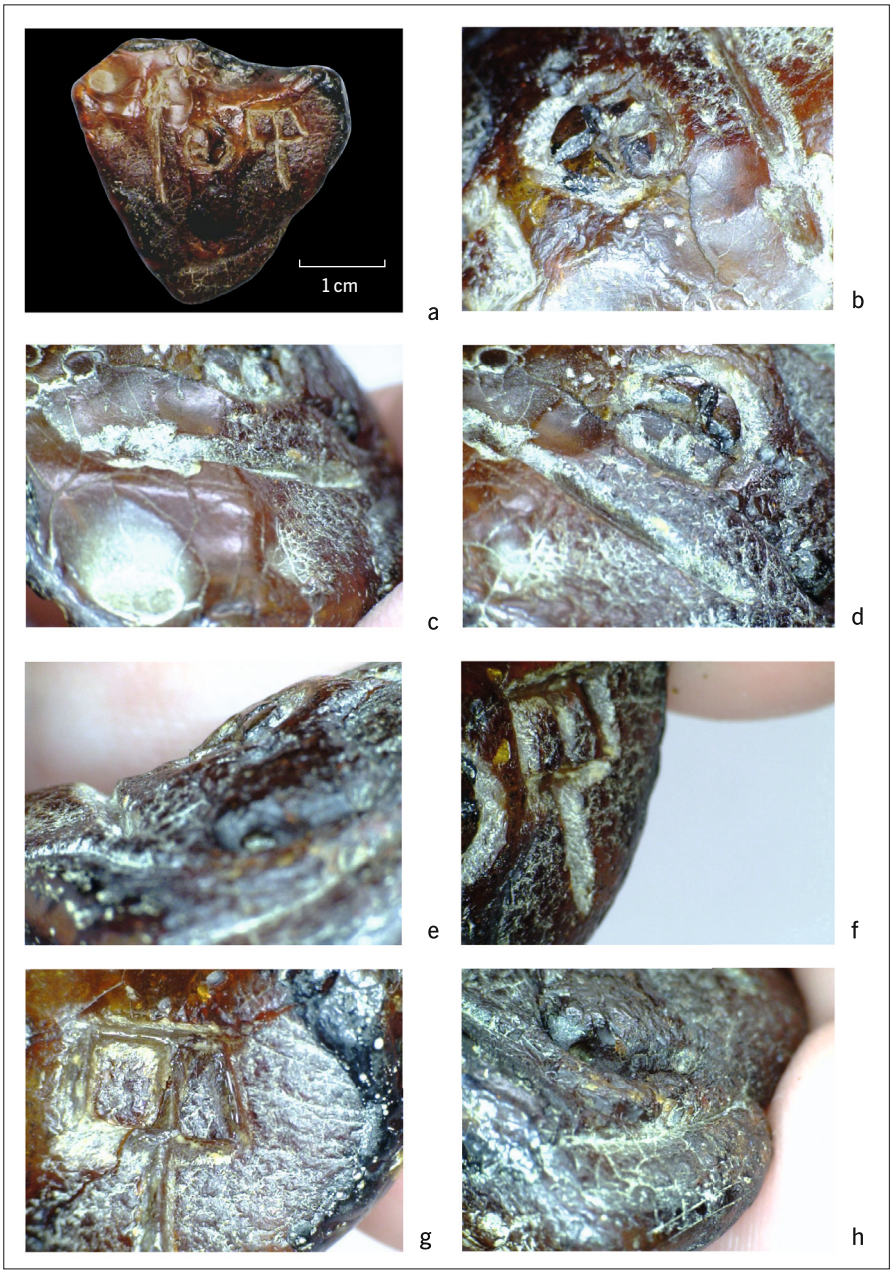

Fig. 37a–h Bernstorf, Freising district, Bavaria. B10 - Amber 'face'. *a* rear side showing the three engraved 'symbols'; *b* top of the 'wheel' symbol with part of adjacent symbols. Note the traces of burning on different parts of the 'wheel'; *c* smooth surface in top left corner of rear side; *d* 'wheel' symbol and shaft of the 'spear' symbol. Note the traces of burning in some of the grooves of the 'wheel'; *e* side view showing (on left) profile of one of the engraved lines; *f* the 'square' symbol. Note how the engraved lines cut into the weathered surface, leaving the two internal sections standing proud. Note the 'varnish' in the engraved lines; *g* the 'square' symbol. Note how the symbol crosses from the weathered to the unweathered surface with no change of line; *h* natural weathering on rear. 37b–h not to scale.

	the smooth, melted areas the engravings appear somewhat lighter under UV light as if covered by a very weak, slightly milky veil [weak fluorescence].) (Gebhard/Rieder 2002, 122–123).
Dimensions	32 x 31 x 10 mm
Worked	On the front is engraved a stylised face with eyes, nose, mouth, ears and short beard. On the rear are engraved three possibly 'Linear B' symbols.
Other alterations	No
Conservation measures	Unknown. See entry for B03.
Other remarks	No
Published	Gebhard/Rieder 2000, 45 Fig. 37. – Gebhard/Rieder 2002, 121 Fig. 5; 124 Fig. 8. – Moosauer/Bachmaier 2005, 103–117; 105 Fig. 149, Fig. 150; 108 Fig. 160. – Hughes-Brock 2011, 104 Fig. 9.2, Fig. 9.3, Fig. 9.7. – Rieder 2014, 116–119. – Janko/Arbor 2015, 42 Fig. 2 – Gebhard/Krause 2016, 62–64; 71–72; 118–122; 125–126; 126 Fig. 81; 148 Tab. 12 (13, 14). – Hochleitner/Rewitzer 2016, 265–266. – Bähr 2016, 267–274; 272–273 Tab. 1. – Rohde 2016, 282–287; 301; 287 Tab. 1.
Comments	See the report text for further comments on this object. According to Gebhard (pers. comm. in October 2014), the ASM has made two replicas of this item. The original was scanned and the replicas produced in coloured resin using a computer-aided production process. One of these replicas is on display in the Bronzezeit Bayern Museum in Kranzberg. The other is probably stored in the ASM. In 2010 the author saw and photographed this item (or one of the replicas) on display in the Bronze Age gallery of the ASM.

Catalogue No. B11 - Perforated amber 'seal' (Fig. 38a–d; Fig. 39a–h; Fig. 40a–h)

ASM Inv. No.	*a* 2004/345 - ASM Finds Label October 2014; *b* 2000/106 *[sic]* - Bähr 2016, 272–273 Tab. 1.
Date found; Found by	18.11.2000 (Saturday); Moosauer/Bachmaier
Context	Stray find amongst disturbed tree roots in „Fläche 3" *(Area 3)* „[...] etwa 50 m von der Fundstelle des Goldfundes [...]" *(... about 50 m distant from the gold findspot ...)* (Gebhard/Rieder 2002, 121).
Form	In the shape of a seal, with a flat front and perforated stem.
Condition	In excellent general condition, bright, clear and translucent, except for some burning/charring on one end. The surface is polished, although numerous scratches (manufacturing marks?) still remain (Fig. 39c–d.f). There are several large, natural cracks and fissures within the body of the piece. There is fresh, unweathered damage around the perforation which cuts across the engraved lines (Fig. 39g). When found the object was encased in an 'envelope' of sand/clay sediment, a mixture local to the Bernstorf hill. This envelope was damaged in one place, which allowed the amber to be seen. When the envelope was removed in the ASM, Gebhard described the condition as 'like new' (Gebhard/Rieder 2002, 124).
Colour	Uniform, pale translucent yellow.
Weathering	Very minimal weathering on the surface, which only occurred after the piece was released from its clay/sand 'envelope' at the ASM (Gebhard/Rieder 2002, 124). None of the internal cracks or fissures are weathered.

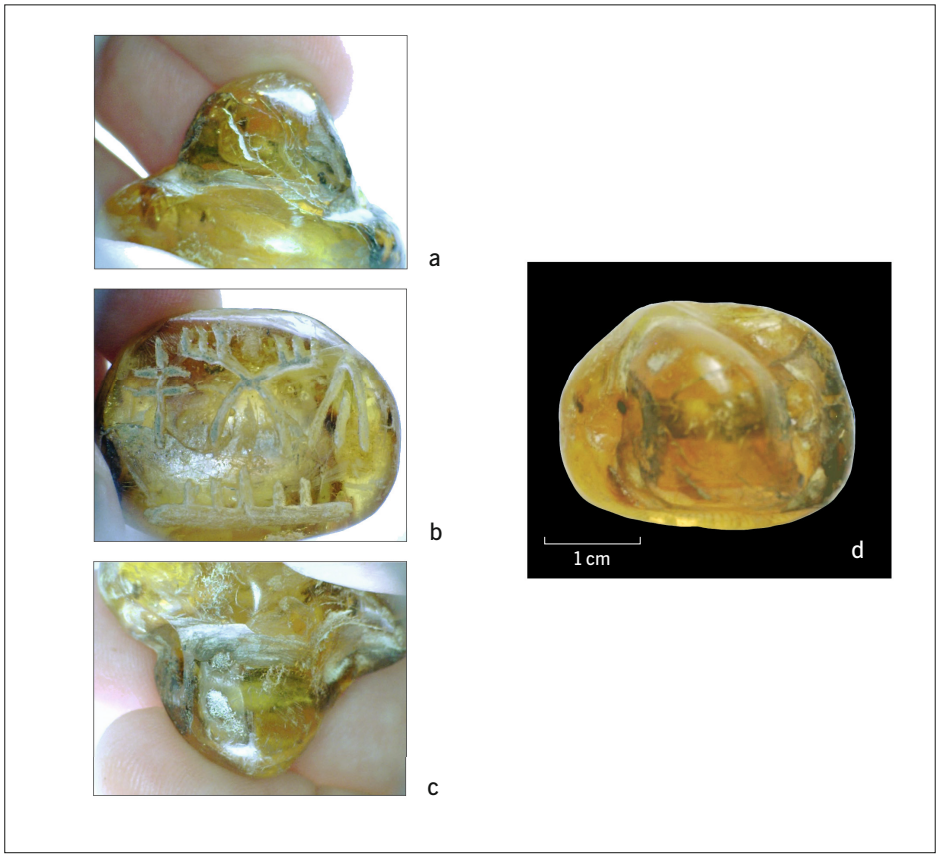

Fig. 38a–d Bernstorf, Freising district, Bavaria. B11 - Perforated amber 'seal'. *a* edge 1; *b* surface showing engraved symbols; *c* edge 2; *d* rear with protrusion. Note the fresh, polished, completely unweathered and translucent nature of the piece. 38a–c not to scale.

Fluorescence Yes. Tested by ASM. [Seal] „Die Oberfläche weist unter UV-Licht schwache Fluoreszenzerscheinungen auf, sie erscheint wie mit einem milchigen Schleier ‚überzogen'. [...] Die Oberfläche der Rückseite weist schwächere Fluoreszenzerscheinungen als die Schauseite auf. Eine starke Fluoreszenz zeigt sich an der kreisrunden rezenten Abplatzung neben dem Bohrloch." *(The surface fluoresces weakly, it appears as if a "covered" by a milky veil... The back surface is weakly fluorescent like the engraved side. There is strong fluorescence in the recent chipping next to the perforation.)* (Gebhard/Rieder 2002, 125–126).

Dimensions 31 x 24 x 21 mm

Worked Original amber piece modified to make the 'seal-shape'. The projection on the back has been enhanced by grooves cut around it. Three 'Linear B' symbols and stylised 'diadem' engraved into the slightly domed front. Perforated stem.

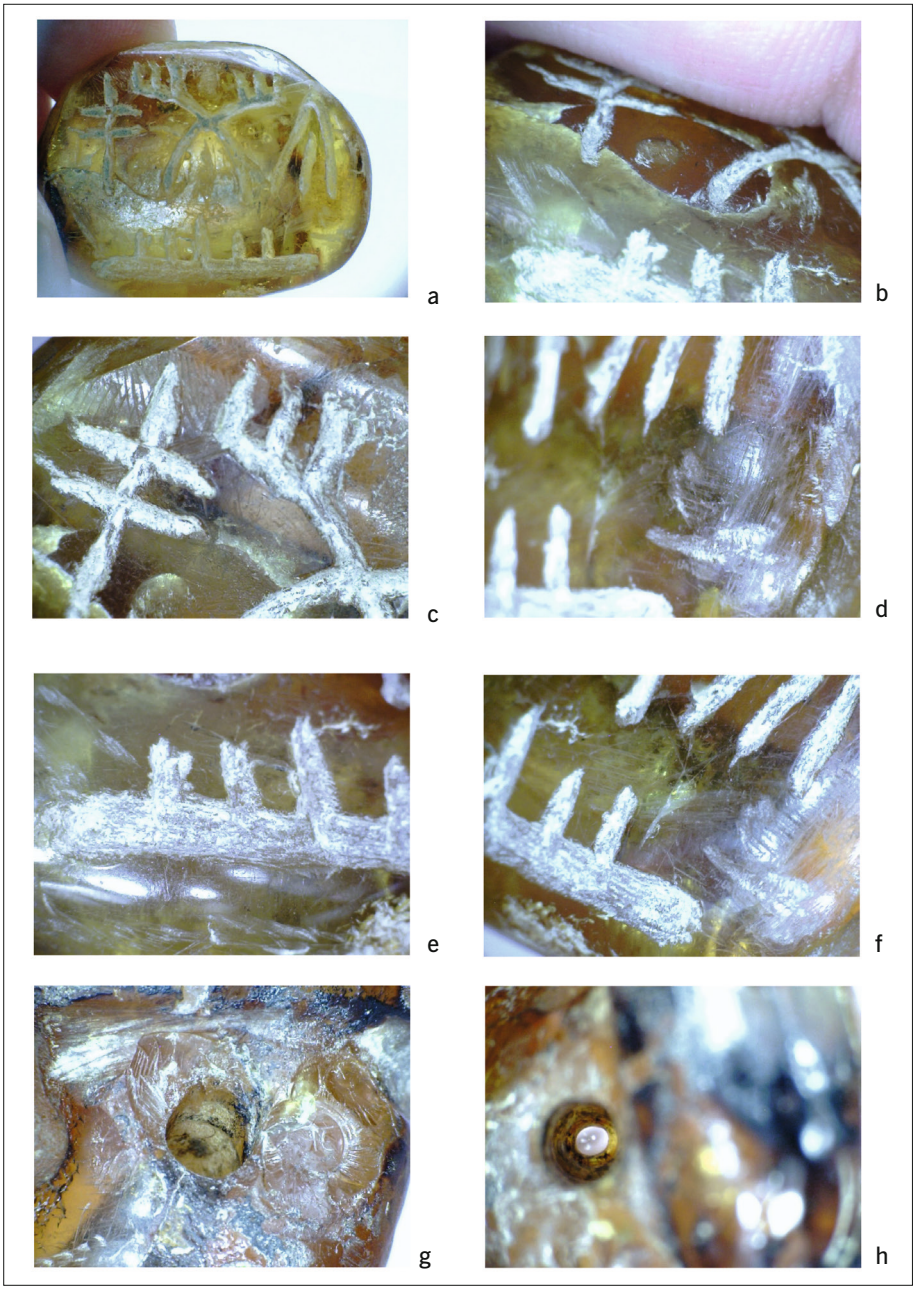

Fig. 39a–h Bernstorf, Freising district, Bavaria. B11 - Perforated amber 'seal'. *a* the whole surface; *b* the natural, unweathered 'loop' fracture; *c–f* close-ups of details of the engraved symbols and the polished surface. Note the small, parallel striations on the surface. Note the traces of grooves in the engraved lines; *g* entrance on left side of the perforation through the protrusion on the rear. Note the extensive, unweathered damage around the perforation; *h* looking directly into the perforation. The light circle in the centre is where the two sides of the perforation meet, creating a much smaller actual aperture. Not to scale.

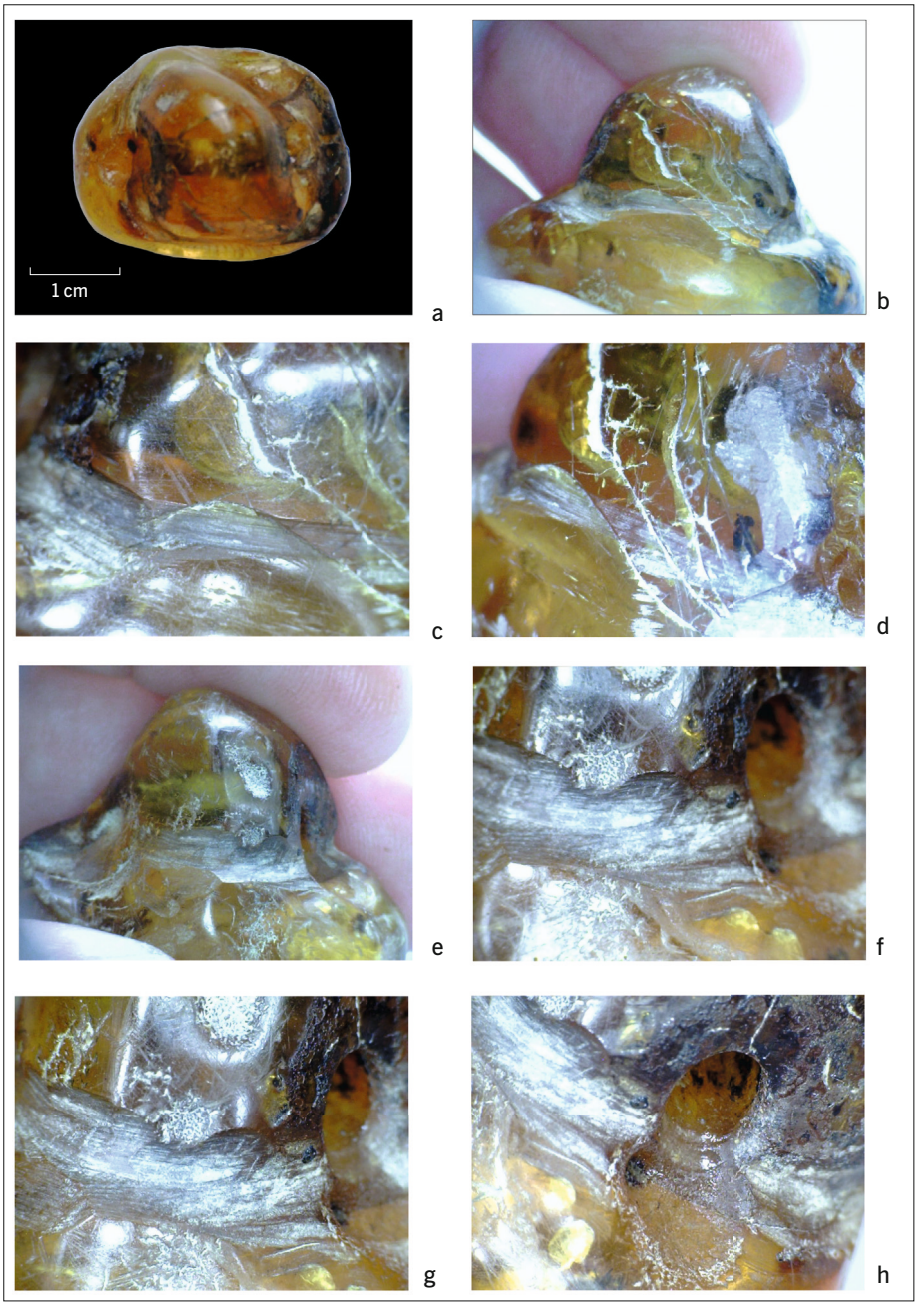

Fig. 40a–h Bernstorf, Freising district, Bavaria. B11 - Perforated amber 'seal'. *a* the rear of the 'seal'. Note the fresh and unweathered condition; *b–d* edge 1 of the 'seal' showing the natural fracture-line running through the protrusion; *e–g* edge 2 of the 'seal' showing the groove cut to accentuate the protrusion. Note the sharp, unweathered edges of the cut and the grooves inside it; *h* entrance on the right side of the perforation through the protrusion, cutting through the groove. Note the depression at the bottom edge of the perforation caused by the drill-bit rubbing against the surface. 40b–h not to scale.

	The perforation is conical from both ends, where it is c. 3 mm wide. Inside, at the point where these two borings meet, the hole appears to be only 0.5 mm wide (Fig. 39h). This appears to be the true size of the hole at that place as there is no evidence that it has been reduced by any weathering or use-wear damage caused by any original thread. Possible manufacturing marks remaining (Fig. 39c–d.f).
Other alterations	No
Conservation measures	Unknown. See entry for B03.
Other remarks	No
Published	Gebhard/Rieder 2000, 45 Fig. 38. – Gebhard/Rieder 2002, 123 Fig. 6; 124 Fig. 8, Fig. 9. – Moosauer/Bachmaier 2005, 103–117; 106 Fig. 151–154; 107 Fig. 155; 108 Fig. 160. – Hughes-Brock 2011, 104 Fig. 9.4, Fig. 9.5, Fig. 9.6; 105 Fig. 9.8; Fig. 9.10. – Bähr et al. 2012, 38. – Rieder 2014, 116–119; Fig. on page 119. – Janko/Arbor 2015, 43 Fig. 3; 47 Fig. 5. – Gebhard/Krause 2016, 62–64; 70–72; 98–102; 118–122; 126–128; 98 Fig. 54; 99 Fig. 55; 100 Fig. 56; 101 Fig. 57; 124 Fig. 79; 127 Fig. 82; 148 Tab. 12 (10,11,12). – Hochleitner/Rewitzer 2016, 265–266. – Bähr 2016, 267–274; 272–273 Tab. 1. – Rohde 2016, 284–285; 285 with footnote 92–98; 287 Tab. 1.
Comments	See the main text above for further comments on this object. Inside the perforation two small pieces of gold foil were found the composition of which exactly matched the gold finds from Bernstorf (Bähr et al. 2012, 38; Gebhard/Krause 2016, 70–80; 98–102). According to Gebhard (pers. comm. in October 2014), the ASM has made two replicas of this item. The original was scanned and the replicas produced in coloured resin using a computer-aided production process. One of these replicas is on display in the Bronzezeit Bayern Museum in Kranzberg. The other is probably stored in the ASM. In 2010 the author saw and photographed this item (or one of the replicas) on display in Bronze Age gallery of the ASM.

Catalogue No. B12 - Six unworked pieces of amber (Fig. 41)

ASM Inv. No.	No ASM finds number
Date found; Found by	November/December 2000; Bachmaier
Context	„Lesefunde *[Stray find]* Bachmaier November/Dezember 2000" – ASM label.
Form	Six small, amorphous pieces.
Condition	Small pieces of amber, all complete.
Colour	Some very lightly weathered pieces are a clear, orange colour. Others which are more weathered are darker orange.
Weathering	Some very lightly weathered, others are only slightly more weathered.
Fluorescence	Yes. Tested by ASM. [Test No. 4] „Bernsteinstücke, die im November 2000 aufgelesen wurden. Die Stücke weisen leichte Fluoreszenzerscheinungen auf [2.1.2001]." *(Amber pieces collected in November 2000. These pieces gave off a light fluorescence [2.1.2001].)* (Gebhard/Rieder 2002, 127).
Dimensions	Varied. All between 6–15 mm in length.
Worked	All pieces are unworked.

Fig. 41 Bernstorf, Freising district, Bavaria. B12 - Six unworked pieces of amber.

Other alterations	No
Conservation measures	Stored in two 35 mm film canisters. See entry for B03.
Other remarks	Finds Label "Bernstorf, Lkr. Freising".
Published	Gebhard/Rieder 2002, 127 (fluorescence results only). – Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272–273 Tab. 1; 273 with footnote 38.
Comments	These are naturally-shaped, small pieces of amber. These pieces have a light, translucent colour and minimal weathering. In October 2014, a bag of small amber pieces was produced for examination. Inside were 27 items, plus a second bag containing six amber pieces. All were under the same find label, a piece of paper saying „Bernstorf, Lkr. Freising. Lesefunde *[stray finds]*. T. Bachmaier. November/Dezember 2000". Using Table 1 in Bähr's 2016, 272–273, it is possible to say that the 27 pieces belong to her table entry labelled „Lesefunde 1998 – 26 kleine Bernsteinstücke und -splitter [+1 kleiner Kieselstein]" *(Stray finds 1998 – 26 small pieces and chips of amber (+ 1 small pebble))* – (here B02b). The six pieces in the separate bag must belong to her table entry for „Lesefunde *[stray finds]*. T. Bachmaier. November/Dezember 2000." – (here B12). Beyond the general description 'Bernstorf', no context or description of the find circumstances of these pieces is recorded. Therefore there is no archaeological evidence that these pieces can in any way be attributed to prehistoric activity at Bernstorf. The author believes that they should be disregarded from further discussion and interpretation.

Catalogue No. B13 - Unworked piece of amber (Fig. 42a–e)

ASM Inv. No.	195/2000
Date found; Found by	09.12.2000 (Saturday); Moosauer/Bachmaier
Context	*a* „Lesefund Abraum Fl. 3, Durchsuchen des abgeschobenen Bodenmaterials – 09.12.2000." *(Stray find from spoil in Area 3, searching displaced soil on*

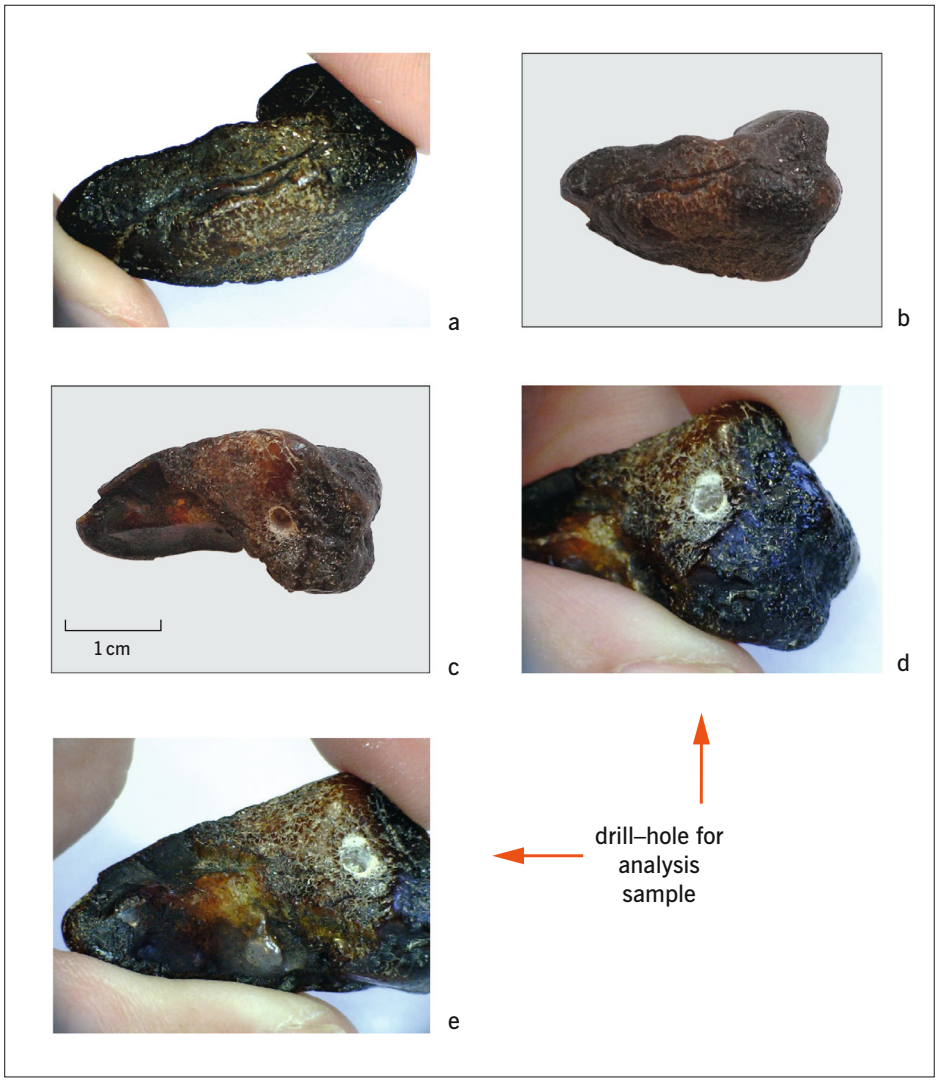

Fig. 42a–e Bernstorf, Freising district, Bavaria. B13 - Unworked piece of amber. *a–b* upper side; *c–e* underside. Note hole for provenance sample (Lühr 2012). Note traces of burning at both ends. In *e* the burning runs over the unweathered surface. 42a–b.d–e not to scale.

09.12.2000.) (Bähr 2016, 272–273 Tab. 1); *b* „Lesefund aus dem Abraum der Fl. 3 [Oberboden Wall]. 09.12.2000“ *(Stray find from the spoil of Area 3 [rampart topsoil], from a search on 09.12.2000)* (Rohde 2016, 287 Tab. 1).

Form
Amorphous piece

Condition
At some point, one end has been broken off (either accidentally or deliberately), leaving a smooth, unweathered, surface scar. There are clear traces of burning/charring on both

	ends, but the central area is unaffected by this.
Colour	Mid-brown in the central area. Both ends are blackened from the burning event.
Weathering	Most of the surface is uniformly medium weathered. The broken end has an unweathered surface scar.
Fluorescence	Not tested by ASM.
Dimensions	31 x 18 x 12 mm
Worked	No
Other alterations	2 mm ø hole for Lühr's 2012 provenance analysis sample.
Conservation measures	Unknown. See entry for B03.
Other remarks	Handwritten on ASM Find Label: „Kopie, Originale verschimmelt und vernichtet" *(Copy, original mouldy and destroyed).*
Published	Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272–273 Tab. 1. – Rohde 2016, 287 Tab. 1.
Comments	This is a naturally-shaped piece of amber. The weathering across the unbroken area of the surface indicates that it was never worked. The missing, broken-off piece, may have been worked, although this seems unlikely. The break appears to be recent and there is no evidence that it was caused in the ancient past in the course of being worked. This is important because the area of burning/charring appears to overlap the break.

Catalogue No. B14 - Unworked piece of amber (Fig. 43a–e)

ASM Inv. No.	197/2000 (a) (197 has two pieces referred to here as a (B14) and b (B15) – see comments).
Date found; Found by	13.12.2000 (Wednesday); Moosauer/Bachmaier
Context	„Lesefund Abraum Fl. 3, Durchsuchen des abgeschobenen Bodenmaterials – 13.12.2000" *(Stray find, spoil from Area 3, searching displaced soil on 13.12.2000)* (Bähr 2016, 272–273 Tab. 1); „Lesefund aus dem Abraum der Fl. 3 [Oberboden Wall] 09.12.2000) [sic]" *(Stray find from the spoil of Area 3 [rampart topsoil] 09.12.2000)[sic])* (Rohde 2016, 287 Tab. 1).
Form	Small, amorphous piece.
Condition	Complete. Undamaged.
Colour	Brown with more orange towards centre. The end with the sample hole is darker than the rest.
Weathering	Medium weathered surface. The higher areas of the surface have been buffed/polished, leaving unpolished areas in the hollows.
Fluorescence	Not tested by ASM.
Dimensions	20 x 12 x 13 mm
Worked	No
Other alterations	2 mm ø hole for Lühr's 2012 provenance analysis sample.
Conservation measures	Unknown. See entry for B03.
Other remarks	No
Published	Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272–273 Tab. 1; 273 with footnote 41. – Rohde 2016, 287 Tab. 1.
Comments	This is a naturally-shaped piece of amber. The weathering across the whole surface indicates that it was never worked nor damaged. At the darker end, the general nature of the surface is identical to the surface of the rest of the piece and, therefore, does not suggest that the darker colour was caused by burning or heating the piece. Bähr (2016, 272–273 Tab. 1) reports three pieces with this finds number but only two pieces were shown to the author at the ASM in October 2014.

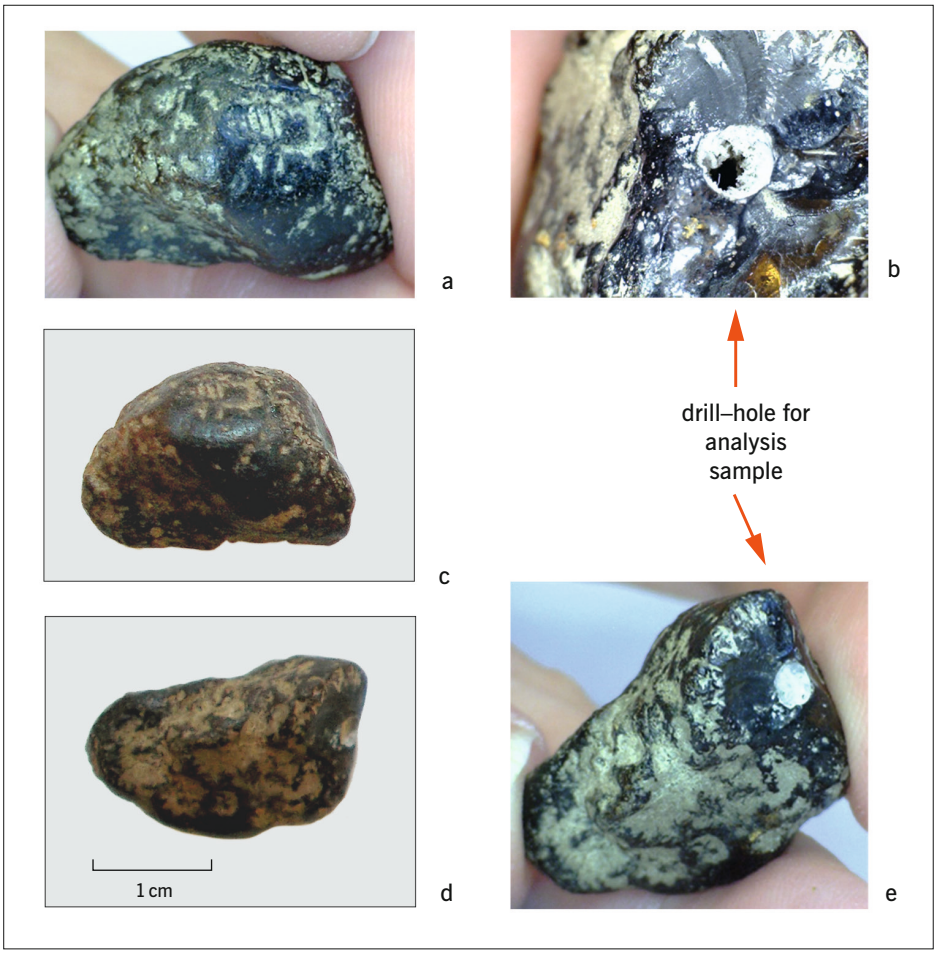

Fig. 43a–e Bernstorf, Freising district, Bavaria. B14 - Unworked piece of amber. *a* upper side; *b* end a. Note hole for provenance sample (Lühr 2012); *c* end b; *d* underside; *e* underside and end a. 43a–c.e not to scale.

Catalogue No. B15 - Unworked piece of amber (Fig. 44a–d)

ASM Inv. No. 197/2000 (b) (197 has two pieces referred to here as a (B14) and b (B15) – see comments).

Date found; Found by 13.12.2000 (Wednesday); Moosauer/Bachmaier

Context *a* „Lesefund Abraum Fl. 3, Durchsuchen des abgeschobenen Bodenmaterials – 13.12.2000“ *(Stray find, spoil from Area 3, searching displaced soil on 13.12.2000)* (Bähr 2016, 272–273 Tab. 1); *b* „Lesefund aus dem Abraum der Fl. 3 [Oberboden Wall] 13.12.2000“ *(Stray find from the spoil of Area 3 [rampart topsoil] 13.12.2000)* (Rohde 2016, 287 Tab. 1).

Form Small, amorphous piece.

Condition Complete. The higher areas of the surface have been buffed/polished, leaving unpolished, rough, dull areas in the hollows.

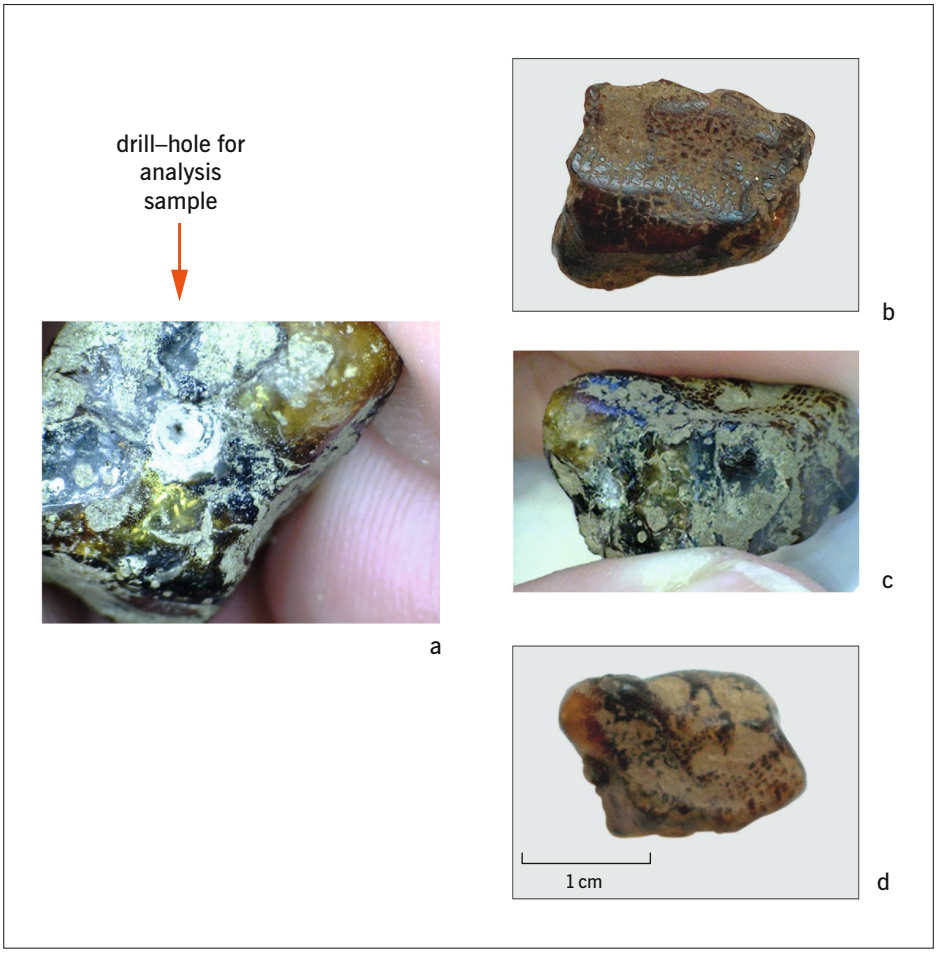

Fig. 44a–d Bernstorf, Freising district, Bavaria. B15 - Unworked piece of amber. *a* end a. Note hole for provenance sample (Lühr 2012); *b* upper side; *c* edge 1; *d* underside. 44a–c not to scale.

Colour	Dark colour over most of surface. At the end with the hole for the analytical sample, the lighter, internal colour of the piece is revealed.
Weathering	Medium weathered surface. Not uniform over the whole piece.
Fluorescence	Not tested by ASM
Dimensions	20 x 13 x 10 mm
Worked	No
Other alterations	2 mm ø hole for Lühr's 2012 provenance analysis sample.
Conservation measures	Unknown. See entry for B03.
Other remarks	No
Published	Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272–273 Tab. 1; 273 with footnote 41.
Comments	This is a naturally-shaped piece of amber. The higher surface areas of the piece are more highly reflective than the surface in the hollows. As this shine is unlikely to be natural, it is more likely that the piece

Fig. 45a–b Bernstorf, Freising district, Bavaria. B16 - Unworked piece of amber. *a* underside; *b* upper side.

has been polished recently. While most of the surface is a dark colour, there are discrete areas where the internal colour shows through. The strong difference in colour (which is much more pronounced than on B14) is unexpected, and difficult to explain in terms of a natural weathering process. It is possible that the surface on these lighter areas may have been polished away to reveal the internal colour. Bähr (2016, 272–273 Tab. 1) reports three pieces with this finds number but only two pieces were shown to the author at the ASM in October 2014.

Catalogue No. B16 - Unworked piece of amber (Fig. 45a–b)

ASM Inv. No.	219/2001 (a)
Date found; Found by	25.04.2001 (Wednesday); Bachmaier
Context	*a* „Lesefund Abraum Fl. 3, Durchsuchen des abgeschobenen Bodenmaterials – 25.04.2001." *(Stray find, spoil from Area 3, searching displaced soil on 25.04.2001.)* (Bähr 2016, 272–273 Tab. 1); *b* „Lesefund aus dem Abraum der Fl. 3 [Oberboden Wall] 25.04.2001" *(Stray find from the spoil of Area 3 [rampart topsoil] 25.04.2001)* (Rohde 2016, 287 Tab. 1).
Form	Triangular profile.
Condition	Complete. Undamaged.
Colour	Mid brown
Weathering	Medium weathering with typical crazed surface.
Fluorescence	Not tested by ASM.
Dimensions	39 x 15 x 9 mm
Worked	No
Other alterations	No
Conservation measures	Unknown. See entry for B03.
Other remarks	No
Published	Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272–273 Tab. 1. – Rohde 2016, 287 Tab. 1.

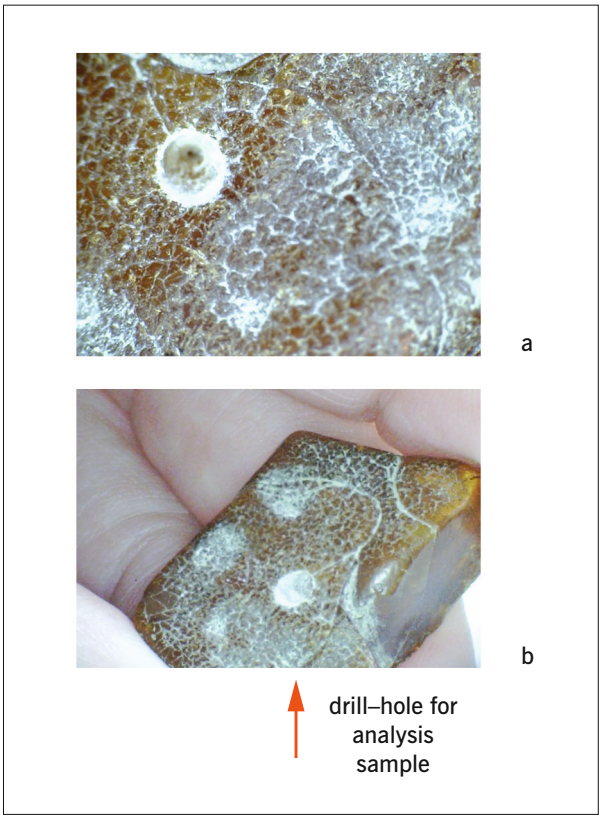

Fig. 46a–b Bernstorf, Freising district, Bavaria. B17 - Unworked piece of amber. *a–b* underside. Note hole for provenance sample (Lühr 2012). Not to scale.

Comments This is a naturally-shaped piece of amber.

Catalogue No. B17 - Unworked piece of amber (Fig. 46a–b)

ASM Inv. No. 219/2001 (b)
Date found; Found by 25.04.2001 (Wednesday); Bachmaier
Context *a* „Lesefund Abraum Fl. 3, Durchsuchen des abgeschobenen Bodenmaterials – 25.04.2001" (*Stray find, spoil from Area 3, searching displaced soil on 25.04.2001)* (Bähr 2016, 272–273 Tab. 1); *b* „Lesefund aus dem Abraum der Fl. 3 [Oberboden Wall] –25.04.2001" *(Stray find from the spoil of Area 3 [rampart topsoil] –25.04.2001)* (Rohde 2016, 287 Tab. 1).
Form Triangular profile. Similar general shape to B15.
Condition Complete. Undamaged.
Colour Mid brown
Weathering Medium weathering.
Fluorescence Not tested by ASM.
Dimensions 28 x 18 x 8 mm
Worked No
Other alterations 2 mm ø hole for Lühr's 2012 provenance analysis sample.
Conservation measures Unknown. See entry for B03.
Other remarks No
Published Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272–273 Tab. 1. – Rohde 2016, 287 Tab. 1.

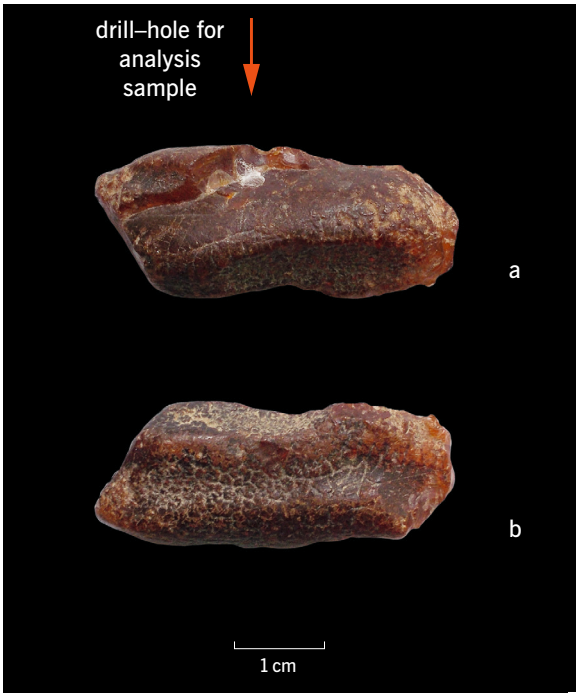

Fig. 47a–b Bernstorf, Freising district, Bavaria. B18 - Unworked piece of amber. *a* upper side. Note hole of provenance sample (Lühr 2012); *b* underside.

Comments This is a naturally-shaped piece of amber.

Catalogue No. B18 - Unworked piece of amber (Fig. 47a–b)

ASM Inv. No. 230/2001

Date found; Found by Context 25.05.2001 (Friday); Bachmaier *a* „Lesefund Abraum Fl. 3, Durchsuchen des abgeschobenen Bodenmaterials – 29.05.2001 *[sic]*". *(Stray find, spoil from Area 3, searching displaced soil on 29.05.2001 [sic].)* (Bähr 2016, 272–273 Tab. 1); *b* „Lesefund aus dem Abraum der Fl. 3 (Oberboden Wall). Grabungstagebucheintrag 29. Mai 2001: Auf Fundzettel, Fundumstände: „Lesefund T. Bachmaier vom 25.05.01, gelagerter Abraum Fl. 3, ragte aus dem Abbauprofil, siehe Profilzeichnung". [...] „Eintrag zu Fundkartierung auf Skizze des Abraumprofils: „angebl. Fundplatz letzter Bernsteinfund T. Bachmaier vom 25.5.01, Fz Nr. 230" *(Stray find from the spoil of Area 3 [rampart topsoil]. Excavation diary entry 29 May 2001: On the finds label, find context: "Stray find T. Bachmaier on 25.05.01, spoil heap from Area 3, protruding from [bulldozed] cut/section, see section drawing. ... entry on mapping of finds on sketch of the [bulldozed] cut/section: alleged findspot of the last amber find T. Bachmaier from 25.5.01, finds label No. 230.)* (Rohde 2016, 287 Tab. 1).

Form	Amorphous shape
Condition	Complete. Large scar on upper surface. No burning observed.
Colour	Dark red
Weathering	Surface colour consistent with medium weathered amber.
Fluorescence	Not tested by ASM.
Dimensions	37 x 12 x 10 mm
Worked	No
Other alterations	2 mm ø hole for Lühr's 2012 provenance analysis sample.
Conservation measures	Unknown. See entry for B03.
Other remarks	Handwritten on ASM Find Label: „1 Bernstein, länglich, mit Hitzespuren". (1 long amber piece, with traces of heating).
Published	Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272–273 Tab. 1. – Rohde 2016, 287 Tab. 1.
Comments	This is a naturally-shaped piece of amber. There is damage in the form of a scar on the upper surface. The weathered condition of the scar shows that this was ancient damage. The piece has not been worked. The finds label says that this piece shows traces consistent with being exposed to heat („Hitzespuren"). This is not the case. The colour and roughness of the surface is completely consistent with naturally weathered amber.

Catalogue No. B19 - Unworked piece of amber (Fig. 48a–f)

Ref. No.	Find Label No.: 611/2002
Date found; Found by	09.10.2002 (Wednesday); Theodor Lup, during BLfD excavations.
Context	*a* Found in a wheelbarrow-load of material from area around „Der Befund 1320" *(Context 1320).* „Der Befund 1320 wird als zum Teil sandig, hart und krustenartig verziegelte Schicht aus dem Kernbereich der Brandzone der Holz-Erde-Mauer beschrieben." *(Context 1320, a partly sandy, hard and crusty burnt layer, from the core of the fire zone of the earth and timber wall.)* (Rohde 2016, 285 with footnote 102; 287 Tab.1); *b* („Anlegen Planum 6 in Fläche 6/2002, Teilfläche NOPQ/02, Befund 1320, Bernstein ausgelesen aus abgetragenem Befundmaterial; Grabung BLfD – [09.10.2002]".) Found during the *creation of Planum 6 in Area 6/2002, Subarea NOPQ/02, Context 1320, amber picked out of material from excavated context, BLfD excavation – (09.10.2002)* (Bähr 2016, 272–273 Tab. 1); [...] *c* „Durchsuchen des Schubkarrens, Fl.Nr. 951, Gmkg. Kranzberg, lokales Messsystem: Aushub Bef. 1320, Fl. 6, Pl. 5–6, Wall. Grabungstagebucheintrag 8. Oktober 2002: Besuch Bachmaier." *(... Searching [soil] in wheelbarrow, Land Parcel No. 951, Kranzberg borough, local measurement system: spoil from Context 1320, Area 6, Planum 5–6, rampart. Excavation diary entry October 8, 2002: Bachmaier visit.)* (Rohde 2016, 287 Tab. 1).
Form	Triangular shaped piece (90 ° angle) with one corner missing. 'Wrinkled' upper surface. Uneven underside surface.
Condition	The short edge has a natural hollow with darker organic staining. The longer edge has smooth areas, hollows and a natural scar. The diagonally-aligned edge is rough at one end and smooth at the other. The remaining edge of the missing 'corner' is slightly pitted.

Fig. 48a–f Bernstorf, Freising district, Bavaria. B19 - Unworked piece of amber. *a* upper side; *b* edge 1; *c* end a. Note hole for provenance sample (Lühr 2012); *d* underside; *e* end b; *f* edge 2.

Colour	Mid-orange
Weathering	Uniform medium weathering across the whole surface.
Fluorescence	Not tested by ASM.
Dimensions	30 x 30 x 12 mm
Worked	No.
Other alterations	2 mm ø hole for Lühr's 2012 provenance analysis sample.
Conservation measures	Unknown.
Other remarks	„Bayerische Landesamt für Denkmalpflege, Referat Archäologische Plangrabungen. Projekt: Bernstorf, Bronzezeitliche Ringwallanlage, Ausgrabung 2002. Grabungsort: Bernstorf. Gemeinde: Kranzberg. Landkreis: Freising" *(Bavarian State Office of Conservation, Department of Archaeological Research Excavations. Project: Bernstorf, Bronze Age circular enclosure, excavation 2002. Excavation site: Bernstorf, Kranzberg borough, Freising district)* (BLfD record sheet).
Published	Gebhard/Krause 2016, 64. – Bähr 2016, 267–274; 272 Fig. 5, 272–273 Tab. 1. – Rohde 2016, 281 with footnote 58; 283 with footnote 76; 285 with footnote 101–102; 287 Tab. 1.
Comments	This is a naturally-shaped piece of amber. The wrinkling on the upper surface and flat areas on the longer edge were formed when the resin extruded from the tree and was still viscous. The wrinkling is not the result of a more recent 'melting' episode. The weathering across the surface indicates that this piece was never worked. This piece was not found *in situ*. In October 2014 this piece was in the care of Vanessa Bähr, M. A., Goethe University, Frankfurt am Main.

Catalogue No. B20 - Unworked piece of amber (Fig. 49a–f)

Ref. No.	44776 E/F85
Date found; Found by	24.08.2005 (Wednesday); G. Mittermaier (volunteer) during BLfD excavation (Rohde 2016, 285 with footnote 103; 285–286; 303–305; 287 Tab. 1).
Context	*a* „Fläche 6/05, südliche Wallböschung (außerhalb der BZ-Befestigung), Grabung BLfD" *(Area 6/05, south of the rampart (outside the Bronze Age fortification), Excavation BLfD)* (Bähr 2016, 272–273 Tab.1); *b* „Abtrag Wall, oberste Schicht der Außenböschung, Fl.Nr. 951, Gmkg. Kranzberg, Fl. 6, Schicht 4, Wall." *(During removal of rampart, uppermost layer of the outer slope. Land Parcel 951, Kranzberg. Area 6, Layer 4, rampart)* (Rohde 2016, 287 Tab.1).
Form	Roughly rhomboidal piece with rounded edges. Uneven upper surface. Flat lower surface.
Condition	Complete. Chipping in centre of underside surface, possibly caused by an initial attempt to drill a hole for the analytical sample. Otherwise no other damage.
Colour	Mid-orange
Weathering	Uniform medium weathering across the whole surface.
Fluorescence	Not tested by ASM.
Dimensions	22 x 22 x 12 mm
Worked	No
Other alterations	2 mm ø hole for Lühr's 2012 provenance analysis sample.
Conservation measures	Unknown.
Other remarks	„Bemerkung: F85" *(Comment: F85)*. (BLfD Record Sheet).
Published	Gebhard/Krause 2016, 64. –

Fig. 49a–f Bernstorf, Freising district, Bavaria. B20 - Unworked piece of amber. *a* underside; *b* edge 1; *c* end a. Note hole for provenance sample (Lühr 2012); *d* upper side; *e* end b; *f* edge 2.

Bähr 2016, 267–274; 272–273 Tab. 1. – Rohde 2016, 285 with footnote 103; 285–286; 303–305; 287 Tab. 1.

Comments This is a naturally-shaped piece of amber. The uniform weathering across the whole surface indicates that it was never worked nor damaged. In October 2014 this piece was in the care of Vanessa Bähr, M. A., Goethe University, Frankfurt am Main.

Abbreviations

Abdr.	Abdruck/Copy
Anon.	anonym/anonymous
ASM	Archäologische Staatssammlung, München/Bavarian State Archaeological Collection, Munich
AVF	Archäologischer Verein Freising/ Freising Archaeological Society
BLfD	Bayerische Landesamt für Denkmalpflege/Bavarian State Office of Conservation
BR	Bayerische Rundfunk/Bavarian Broadcasting
BzA, BzB, BzC	Bronzezeit/Bronze Age (phases BzA, BzB, BzC)
Cat.	Katalog/Catalogue
Fig.	Abbildung/Figure
Fz	Fundzettel/finds label
Gde.	Gemeinde/Borough
GUF	Goethe-Universität, Frankfurt am Main/Goethe University, Frankfurt/ Main
Inv.	Inventar/Inventory
IRS	Infrarotspektroskopie/Infrared Spectrometry
LDA	Landesamt für Denkmalpflege und Archäologie Sachsen-Anhalt/State Office for Heritage Management and Archaeology Saxony-Anhalt
Lkr.	Landkreis/District
No.	Nummer/Number
pH	pH-Wert – Wasserstoffpotential/ potential of hydrogen
Py-GC	Pyrolyse-Gaschromatographie/ pyrolysis gas chromatography
Py-GCMS	Pyrolyse-Gaschromatographie-Massenspektrometrie/pyrolysis gas chromatography mass spectrometry
Ref. No.	Referenznummer/Reference number
SAM	Sonderarbeitsmaßnahme/job creation scheme
Tab.	Tabelle/Table
TBK	Trichterbecherkultur/Funnel Beaker Culture
UV	ultraviolet

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1	A. Gottstein (LDA), after Bähr 2016, 267 Fig. 1 and Rohde 2016, 278 Fig. 2
2	A. Gottstein (LDA), after Krumbiegel/Krumbiegel 1996, 32: with addition of Baltic amber limits (revised), after Pastorelli 2009, 8 Fig. 1.7
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