Holding Together: Exploring the Efficacy of Mesolithic and Neolithic Adhesive Technologies

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MA by Research
32,393 Words

University of York
Archaeology

March 2022

Abstract

This thesis examines continuity and difference in adhesive usage and production upon Neolithisation, evaluating Late Epipalaeolithic/Mesolithic and Neolithic material from European and Near Eastern sites via database analysis. The majority of archaeological adhesive studies focus on a single site or find, with synthesis only emerging in recent years, largely limited to a specific period. We can question our wider understanding of adhesive usage and production without detailed analysis – as this study attempts – of research to date. This analysis is complemented by strength and water resistance testing of a broad range of adhesive substances, deriving from these regions, as a critiquing factor. Archaeological data indicates strong continuity between the two periods, with primary adhesive choices specific to each region – birch tars preferentially utilised in Europe and bitumen employed in the Near East. Evidence of adhesive production is limited and difficult to interpret outside plaster adhesives, remaining largely theoretical in nature. However, we can question the validity of the archaeological record, with adhesive preservation likely playing a significant role. Data concentration within Northern/Central Europe and the Fertile Crescent might also significantly bias the record in favour of certain adhesives. Notwithstanding, archaeological data strongly aligns with experimental results indicating tars/bitumen possess greater strength and innate waterproofing qualities compared with resins and other adhesives. European contexts attest a more diverse range of adhesives, partly attributable to greater analysis of ceramic materials and lack of widespread chemical analysis in Near Eastern contexts. One major change, however, remained unambiguous – massive increases in plaster usage for architectural purposes upon Neolithisation. On the whole, the conclusions of this thesis remain tentative – further research is needed to fully explore the impact of adhesive properties on both use selection and archaeological preservation.

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Acknowledgements

I would like to thank everyone who has helped and supported me during the completion of this thesis. Special thanks go to my supervisor, Andy Needham, for his exceptional patience over the course of an extended, socially distanced, masters process necessitated by a truly surreal set of external circumstances in 2020-21. His advice and constant support and reassurance have been invaluable – and his assistance around the campfire with experimental work warmly appreciated.

I must also thank Aimée Little for her advice and suggestions during the TAP meeting held in March 2021. She assisted in giving me a clearer steer to navigate my thesis after I was thrown off my original bearings by the storm that was 2020. Andy Langley also provided necessary assistance producing several of the tools utilised in this thesis.

Throughout the research, experimentation and drafting of my thesis I have had the support of Ann Demaret, my Specialist Mentor, and Trish Campion, my Study Skills Mentor. Their help and support in keeping me sane over the course of writing this thesis cannot be overstated.

Finally, I'd like to thank my family for their understanding over the course of the past year. They've kept me grounded, focused (and fueled) – and have put up with some highly irregular working hours. Their love and constant encouragement is always a massive support to me.

Declaration

I declare that only original work is presented in this thesis, of which I am the sole author. This work has not previously been presented for an award, either at the University of York or any other higher education institution. All sources are acknowledged in the references section.

1: Introduction

1.1: Adhesives and their History

Adhesive substances play a crucial role in keeping modern industrial societies functioning, being employed in roles as diverse as tarmacking road surfaces, aircraft frame construction, confectionary manufacture and sealing human tissue in surgeries (Skeist, 1990; Hartshorn, 1986; Shields, 1984). Possessing considerable advantages over mechanical means of binding different materials together, they distribute stresses more evenly than bindings or welds, adding less additional weight and being generally quicker to apply (Hartshorn, 1986; Shields, 1984). Adhesives vary in their strength and intrinsic properties, with different methods of preparation and application (Fisher, 2005; Shields, 1984). In archaeological contexts with sufficient preservation, combinations of both adhesive and binding are often attested providing combined reinforcement for pottery repairs and hafted tools – although, in many instances, tools with bindings are attested without adhesives (Wojtczak and Kerdy, 2018; Mirabaud *et al.*, 2015; Helwig *et al.*, 2014; Connan *et al.*, 2008).

While typically categorised by their reactivity – whether they chemically react or simply dry to harden – adhesives can be further differentiated according to their origin (Skeist, 1990; Hartshorn, 1986; Shields, 1984). This is more relevant when considering archaeological adhesives, which all derive from natural (either biological or mineral) sources (Feldman, 2003; Hartshorn, 1986; Shields, 1984). These can be further divided into various subcategories listed below in greater detail (Table 1). Adhesives like these continued to dominate until the emergence of synthetic adhesives such as epoxy resins and cyanoacrylates that could be produced more easily on an industrial scale (Pizzi and Mittal, 2009; Skeist, 1990). Certain subcategories span different origin groups – waxes, for example, can derive from all three categories (Feldman, 2003; Skeist, 1990).

Category	Subcategory	Examples
Animal	Albumin	*Blood Glues; Egg Glues*
	Casein	*Milk Casein Glues*
	Collagen	*Bone Glues, Hide Glues, Sinew Glues*
	Shellac	*Shellac*
	Waxes	*Beeswax*
Vegetable	Carbohydrates	*Starch Glues, Dextrin Glues*
	Latexes	*Asafoetida, Galbanum, Natural Rubber*
	Mucilages	*Aloe Vera, Bluebell Sap, Marshmallow Sap*
	Oils	*Castor Oil, Linseed Oil*
	Proteins	*Soyabean Glues*
	Resins/Gums	*Acacia Gum, Chios Mastic, Conifer Resins, Dammar Gum, Frankincense, Myrrh, Labdanum, Spinifex Resin, Styrax*
	Tars/Pitches	*Birch Bark Tar, Oak Bark Tar, Pine Bark Tar*
	Waxes	*Carnabúa Wax, Jojoba Wax*
Mineral	Bitumen	*Asphalt/Bitumen*
	Plasters/Mortars	*Clay Plaster, Gypsum Plaster, Lime Plaster*
	Resins (Fossilised)	*Amber, Copal*

Table 1. Breakdown of naturally occurring adhesives by category and subcategory (Ebnesajjad and Landrock, 2014; Hartshorn, 1986; Shields, 1984).

Although many adhesives from prehistory appear to have been utilised without additional ingredients, compound adhesives do occur quite frequently and date as far back as 70,000 years ago in Southern Africa (Zhilin, 2017a; Bradtmöller *et al.*, 2016; Lombard, 2007; Wadley, Williamson and Lombard, 2004; Audouin and Plisson, 1982). Additives can be split into two principal types. Aggregates (like sand, charcoal and ochre) act as loading agents to add strength and thicken adhesive mixtures, whereas plasticisers (like beeswax and animal fats) make them more flexible, resistant to impacts and reduce drying time (Kozowyk, Poulis and Langejans, 2017; Kozowyk, Langejans and Poulis, 2016; Wadley, 2005). Aggregates also assist plasticisers by aiding in properly mixing waxes with resins (Kozowyk, Langejans and Poulis, 2016; Wadley, 2005).

Both prehistoric and historic societies depended on adhesive substances to accomplish a variety of goals – the earliest evidence for their use dates back 200,000 years to the Middle Palaeolithic, with several instances of Neanderthal hafting adhesives attested from Mousterian sites in Europe and the Near East (Asryan and Olle, 2020; Degano *et al.*, 2019; Niekus *et al.*, 2019; Cârciumaru *et al.*, 2012; Pawlik and Thissen, 2011a; Mazza *et al.*, 2006; Hardy *et al.*, 2001; Koller *et al.*, 2001). The earliest adhesives utilised by modern humans originate from the African Middle Stone Age (MSA), with plant resins mixed with red ochre as an aggregate element used to haft tools at sites like Sibudu and Rose Cottage Cave (Wojcieszak and Wadley, 2018; Hodgskiss and Wadley, 2017; Bader *et al.*, 2016; Charrié-Duhaut *et al.*, 2013; Lombard, 2007; Wadley, Williamson and Lombard, 2004). Alongside hafting, use of adhesives in binding paints is attested from the Upper Palaeolithic, with analysis of a painting from Riparo Dalmeri (Figure 1) identifying beeswax (Cristiani, Lemorini and Dalmeri, 2012).

The remainder of prehistory gives a more varied impression of adhesive use (Figure 1) – with plasters employed to coat the walls/floors of structures and impressions of human teeth, reeds and barnacles in lumps of adhesive material indicative of use as chewing gums as well as to caulk (waterproof) boat hulls (Papakosta and Pesonen, 2019; Micheli *et al.*, 2018; Yerkes, Khalaily and Barkai, 2012; Kjellström *et al.*, 2010; Connan *et al.*, 2005; Cilingiroğlu *et al.*, 2004; Carter, 2002; Aveling and Heron, 1999). Most prominently of all, the development of pottery in the Late Mesolithic and Neolithic attests a host of different roles for adhesives in waterproofing, repairing and sealing containers, being burned as fuel or incense, added to resinate wine and decorate containers with painted designs (Urem-Kotsou *et al.*, 2018; Kabaciński *et al.*, 2015; Mirabaud *et al.*, 2015; Šoberl *et al.*, 2014; Marangou and Stern, 2009; Mitkidou *et al.*, 2008; Urem-Kotsou *et al.*, 2002; McGovern *et al.*, 1996).

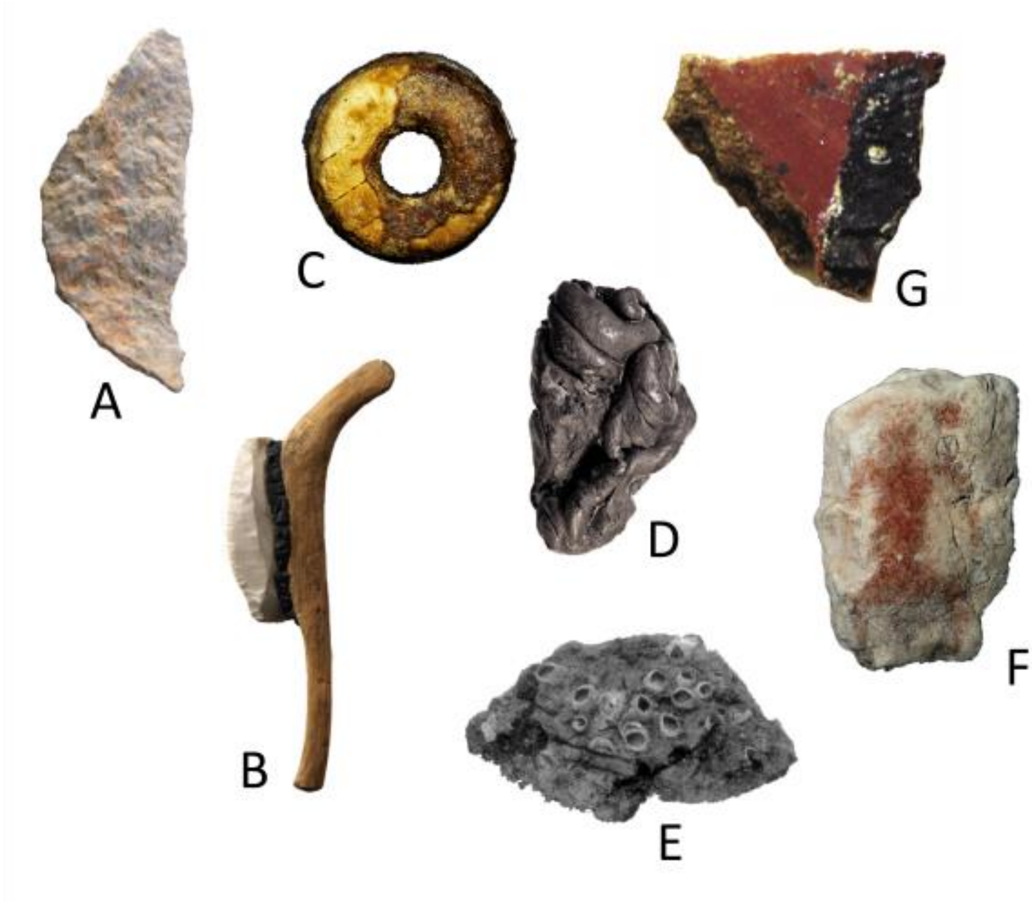


Figure 1. Examples of adhesive evidence types, in order: (A) compound resin-ochre hafting adhesive from MSA Sibudu, (B) preserved sickle hafted with tar from Neolithic Egolzwil 3, (C) stone bead coated with resin from Bronze Age Cova del Gegant, (D) chewed tar from Mesolithic/Neolithic Syltholm, (E), barnacle-encrusted bitumen caulking from Neolithic H3, (F) figure painted with beeswax binder from Upper Palaeolithic Riparo Dalmeri, (G) pottery repaired using birch tar from Neolithic Apsalos (Jensen *et al.*, 2019: Fig. 1; Odriozola *et al.*, 2019: Fig. 4; Urem-Kotsou *et al.*, 2018: Fig. 5;

Gibaja *et al.*, 2017: Fig. 12; Oliveira *et al.*, 2017: Fig. 2; Cristiani, Lemorini and Dalmeri, 2012: Fig. 5; Lombard, 2007: Fig. 2; Connan *et al.*, 2005: Fig. 6).

1.2: Rationale

Even a cursory examination of adhesive evidence demonstrates one key problem – virtually all archaeological studies are conducted within the context of a specific site or find, with research lacking at broader scales examining spatial and temporal differences in adhesive usage and production. While some themes like the preferential usage of birch tars in Europe and bitumen in the Near East by various societies – ranging from the Middle Palaeolithic to the Iron Age and beyond – can be immediately distinguished, the precise extent of this preferential usage, together with how specific adhesive technologies developed temporally, cannot be assessed without more detailed analysis of adhesive use by different prehistoric groups. As for production, there appears little in the way of direct evidence for how adhesives were made ready for use by prehistoric societies, with discussion before the historic period mostly speculative (Rageot *et al.*, 2019; Hennius, 2018; Kozowyk *et al.*, 2017; Orengo *et al.*, 2013). The course of prehistory saw immense technological and societal changes – the Upper Palaeolithic saw increased bodily ornamentation/art production, the Neolithic brought sedentism, agriculture and use of pottery, the Chalcolithic brought metals – yet understanding of how these developments impacted adhesive usage and production remains largely lacking. With increasing evidence of archaeological adhesives available for analysis in recent years, it may now be possible to generate meaningful results from wider-scale analysis of adhesives.

1.3: Aims and Objectives

In order to limit its scope, this thesis will examine a single question: Does adhesive usage and production change with the transition from the Mesolithic to the Neolithic? Neolithisation brought a host of significant developments distinguishing it from other socio-technological shifts mentioned above by their sheer scale – small, mobile bands of hunter-gatherers became (or were replaced by) more densely populated, sedentary agricultural societies, which kept domesticated animals, cultivated farming land and made increased use of permanent structures (Bocquet-Appel and Bar-Yosef, 2008; Bellwood, 2005; Kuijt, 2002). These changes, fundamental to the very nature of societies, might well be expected to have impacted adhesive usage and production considerably. Perhaps most crucially, the development of pottery in the Late Mesolithic and Neolithic provided a stable new medium on which adhesives could be prepared and applied for various purposes, greatly increasing the quantity of evidence available for analysis compared with earlier periods.

To examine this question, this thesis aims to assess the extent to which archaeological evidence demonstrates changes in adhesive usage and production between the Late Epipalaeolithic/Mesolithic and Neolithic periods within Europe and the Near East.

To achieve this aim, the following objectives will be met:

1). To produce a database of archaeological evidence for adhesive usage and/or production during the Late Epipalaeolithic/Mesolithic and Neolithic periods within Europe and the Near East.

2). To conduct experiments to assess the varying performance of different adhesive substances, as a comparative element.

A database will be produced categorising archaeological evidence for adhesive usage and production within a set area, facilitating comparison of evidence forms and supporting development of graphical representations of the dataset for later discussion. Its purview shall be limited to two distinct regions

– Europe and the Near East – to ensure a more coherent dataset. These areas contribute the vast majority of archaeological evidence for adhesives, with finds elsewhere distributed over a wider area and limited in extent. Considerable differences also appear evident between them – despite their proximity and the presence of similar categories of adhesive material in both areas. Bitumen appears to form a majority of Near Eastern adhesives, while tars/resins are predominant in Europe. Significant ecological differences also differentiate the two – with the Near East hotter and more arid compared with the varied but broadly temperate climate of Europe, influencing the adhesive-producing flora available to prehistoric societies (Barry and Hall-McKim, 2014). The precise definition of these regions for the purposes of this thesis are discussed in-depth in Chapter 3. As mentioned above, the Neolithic transition is a particularly suitable topic to focus on when examining visible changes in adhesive usage and production, given the immense impact of its socio-technological developments on societies compared with other periods.

Experimental work will be conducted to identify qualitative differences in adhesive performance (comparative strength, water resistance) to assist discussion of why certain adhesives may have been preferred or avoided. Existing experimental studies largely concentrate on the role of additives in the performance of more archaeologically prominent adhesives, such as pine resin, acacia gum or birch bark tar (Kozowyk, Poulis and Langejans, 2017; Kozowyk, Langejans and Poulis, 2016; Zipkin *et al.*, 2014). While these provide great insight into the performance of adhesives containing differing quantities of aggregates/plasticisers, the narrow range of adhesives assessed is unhelpful for examining *why* certain adhesives were preferred over others. When assessing use of a wider range of geographically available adhesives in the archaeological record, experimental evidence on a broader scale is necessary to draw suitable conclusions. Experimental references to adhesive preservation will be used to highlight potential deficiencies in the archaeological record. Ideally, the author would conduct taphonomic experiments here with a similarly broad range of adhesives, however, achieving significant results would require burial times beyond the available scope of this thesis (Kozowyk, van Gijn and Langejans, 2020).

1.4: Summary

Prehistoric societies exploited adhesive substances for a variety of different purposes, with an increasing quantity of evidence attested in recent years for their use in prehistory. However, our understanding of how technological and societal developments impacted adhesive selection and use remains lacking. To partly remedy this, this thesis examines the impact of the Neolithic transition on adhesive usage and production. The results of this analysis are outlined in the following chapters. The history of adhesive research will be initially considered to assess the factors driving it before the specific methodology employed in this thesis is laid out and justified. Results will then be presented outlining the archaeological/experimental findings made by the author and subsequently examined in a series of discussion chapters evaluating continuities and differences indicated by the archaeological data, contrasted with experimental evidence of adhesive performance and archaeological preservation. The product of the research will then be summarised in a concluding chapter.

2: Literature Review

The following chapter briefly outlines prehistoric adhesive research to date, evaluating the factors that have prompted research into adhesives and highlighting limitations with the current state of analysis – such as limited period and cross-period synthesis – that could (partly) be improved upon by the results of this thesis as a whole. This encompasses research into adhesives from the Middle Palaeolithic, when they are first attested, until the start of the historic period.

2.1: Palaeolithic Adhesives

Growing evidence of Neanderthal behavioural complexity has prompted research into the extent and nature of Middle Palaeolithic adhesive usage as a proxy for assessing cognition (Hoffman *et al.*, 2018a; 2018b; Zilhão, 2012; Pettitt, 2002). Two lumps of dark adhesive unearthed by Mania and Toepfer (1973) at Königsaue, Germany provided the earliest indication that Neanderthals made use of adhesive substances, about 80,000 years ago (Mania and Toepfer, 1973). Subsequent GC-MS analyses performed by Koller, Baumer and Mania (2001) and Grünberg (2002) identified these as birch tar, confirming Neanderthals produced adhesives rather than simply exploiting naturally occurring substances. The cognitive implications are profound – as Neanderthals would have needed to follow a complex and prolonged sequence of tasks to generate usable tar (Niekus *et al.*, 2019; Wragg Sykes, 2015). Further studies have identified similar birch tar residues on lithics from various Mousterian sites in Europe dating as far back as 260-250,000 BP – indicating Neanderthal tar usage was not uncommon (Pawlik and Thissen 2011a; 2011b; Mazza *et al.*, 2006).

Neanderthal adhesive use is not limited to birch tar alone – heavily weathered bitumen has been identified on lithics via GC-MS at Umm el-Tlel (Figure 2) and Hummal in the El Kowm basin, Syria by a number of different studies (Hauck *et al.*, 2013; Monnier *et al.*, 2013; Boëda *et al.*, 2008; Boëda, Connan and Muhesen, 1998; Boëda *et al.*, 1996). The same substance has also been detected by Asryan and Olle (2020) at Azokh 1 in the Caucasus and Cârciumaru *et al.* (2012) at Gura Cheii-Râşnov Cave, Romania. Conifer resin has also been identified on ten lithics from Fossellone and Sant'Agostino (Figure 2) in Central Italy, with one sample containing wax esters suggesting incorporation – either accidental or deliberate – of beeswax into the mixture (Degano *et al.*, 2019).

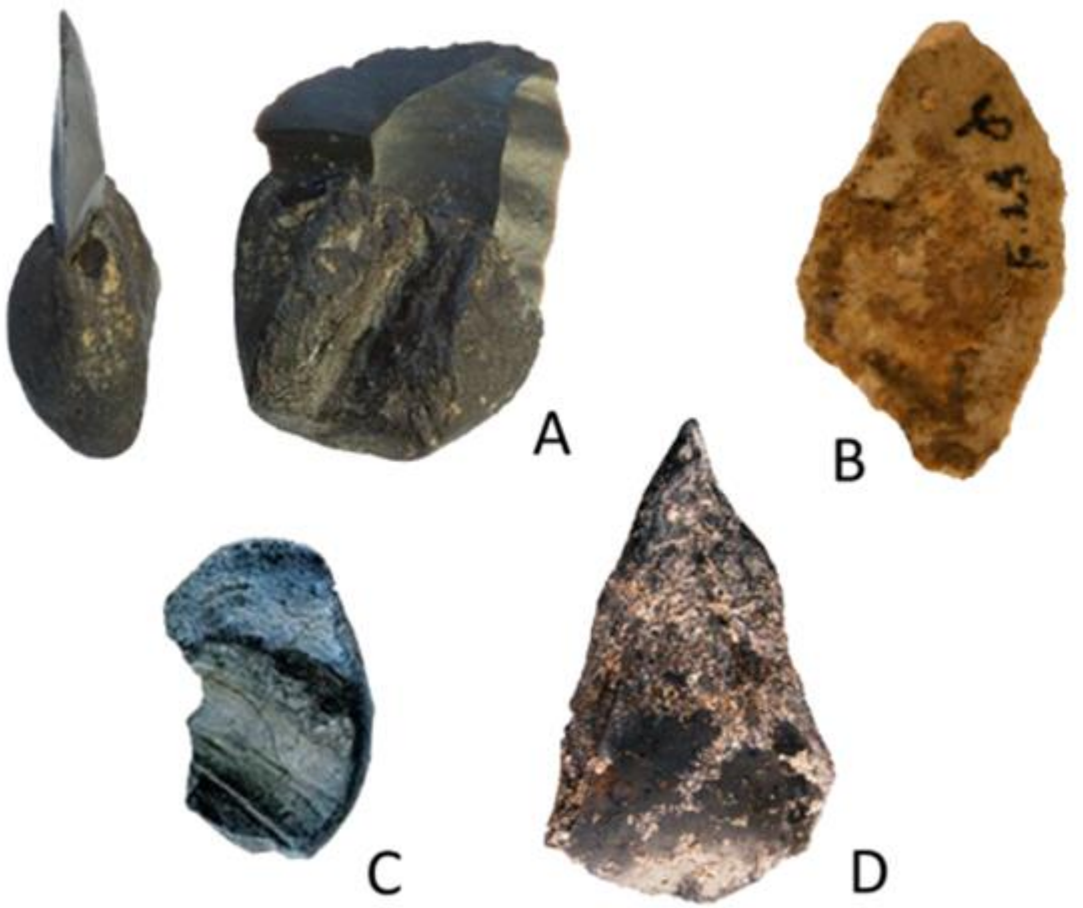


Figure 2. Neanderthal hafting adhesives: (A) thick layer of birch tar covering a tool from Campitello Quarry, (B) traces of conifer resin adhering to a tool from Sant'Agostino, (C) lump of birch tar from Königsaue bearing the imprint of a flint tool, (D) bitumen adhering to a Levallois point from Umm el-Tlel (Degano *et al.*, 2019: Fig. 4; Niekus *et al.*, 2019: Fig. 1; Boeda *et al.*, 2008: Fig. 3).

While Mousterian adhesive evidence derives from a specific focus on adhesive traces as a proxy for Neanderthal cognition, MSA evidence is largely the by-product of similar research concentrating on ochre to investigate the symbolic and technological behaviours of early *Homo sapiens* populations in Africa. Evidence of behavioural modernity in MSA contexts prior to the Upper Palaeolithic symbolic revolution – primarily involving ochre – prompted a surge in research post-2000 (Boyle, Gamble and Bar-Yosef, 2010; Bar-Yosef, 2007; 2002; McBrearty and Brooks, 2000; Clark, 1999). Production of compound hafting adhesives utilising both resins and ochre would be indicative of long-term planning and abstract thought to navigate the various stages required to acquire, process and combine the different materials involved (Wragg Sykes, 2015; Wadley, Hodgskiss and Grant, 2009). Research heavily concentrated on the site of Sibudu, South Africa – with a range of different studies employing microscopy to confirm use of resin-ochre mixtures in hafting across its MSA occupation from the Still Bay to the post-Howiesons Poort (about 80-50,000 BP) (Wojcieszak and Wadley, 2018; Lombard, 2005; Delagnes *et al.*, 2006; Lombard, 2006a; 2006b; 2005; Wadley, Williamson and Lombard, 2004; Williamson, 2004). Adhesives are further attested at other MSA sites. For instance, GC-MS analysis performed by Charrié-Duhaut *et al.* (2013) on a late Howiesons Poort quartz flake from Diepkloof Rock Shelter, South Africa identified thick adhesive deposits as Podocarpus resin mixed with animal fat, fragmented bone and quartz grains – either contaminants or deliberate incorporations to improve adhesive properties.

Research into adhesives from the Upper Palaeolithic and later periods (both prehistoric and historic) generally focuses on resource procurement and technological systems at particular sites rather than behaviour – although studies exploring technological differences at wider scales do exist from the Mesolithic onwards. Like the MSA, greater use is made of microscopy rather than chemical analysis to detect (rather than definitively identify) adhesive substances. Black adhesive at the base of three Aurignacian burins from Les Vachons, France was identified as birch tar by Dinnis, Pawlik and Gaillard

(2009) using SEM-EDX while Cârciumaru *et al.* (2012) utilised a combination of various techniques (FTIR, EDXRF, ICP-AES and XRD) to identify heavily weathered bitumen on a jasper blade from Gura Cheii-Râşnov Cave ascribed to either the Aurignacian or Gravettian. Bradtmöller *et al.* (2016) took a similar multi-analytical approach to identify differences in the choice of adhesives used in hafting five Gravettian points from Cueva Morín, Spain with an unidentified resin (Figure 3) mixed in some instances with burnt bone or ochre aggregates. Black residue at the base of a Final Palaeolithic point from Bergkamen, Germany was identified by GC-MS and FTIR as a beeswax-charcoal mixture after initially being assumed to be birch tar (Baales, Birker and Mucha, 2017), with microscopic analysis of an antler point of roughly similar date from Gransmoor, UK suggesting its hafting with conifer (possibly pine) tar (Sheldrick *et al.*, 1997). Yaroshevich, Nadel and Tsatskin (2013) interpreted black and white calcareous residues (Figure 3) detected via microscopic analysis of five microliths from Ohalo II, Israel dated to 23,000 BP as two varieties of plaster produced from Lisan marl.

Upper Palaeolithic adhesive research is more globally widespread. Thin layers of resin at the base of several stingray spines used as tools at Niah Cave, Malaysia and three lithics from Ille Cave in the Philippines, both analysed using microscopic analysis, remain unidentified (Pawlik, 2012; 2010; Barton *et al.*, 2009). Early rock shelters in Australia have also yielded traces of unidentified resin on some flakes and hatchets, sometimes mixed with ochre (Maloney *et al.*, 2018; Clarkson *et al.*, 2017; Hamm *et al.*, 2016; Clarkson *et al.*, 2015; Fullagar and David, 1997). These studies conducted limited analyses of tool assemblages from regions hitherto neglected in the debate over behavioural and cognitive modernity due to insufficient research, with adhesive use indicative of more complex technological behaviours than previously assumed in this period (Pawlik, 2012; Barton *et al.*, 2009; Brumm and Moore, 2005).

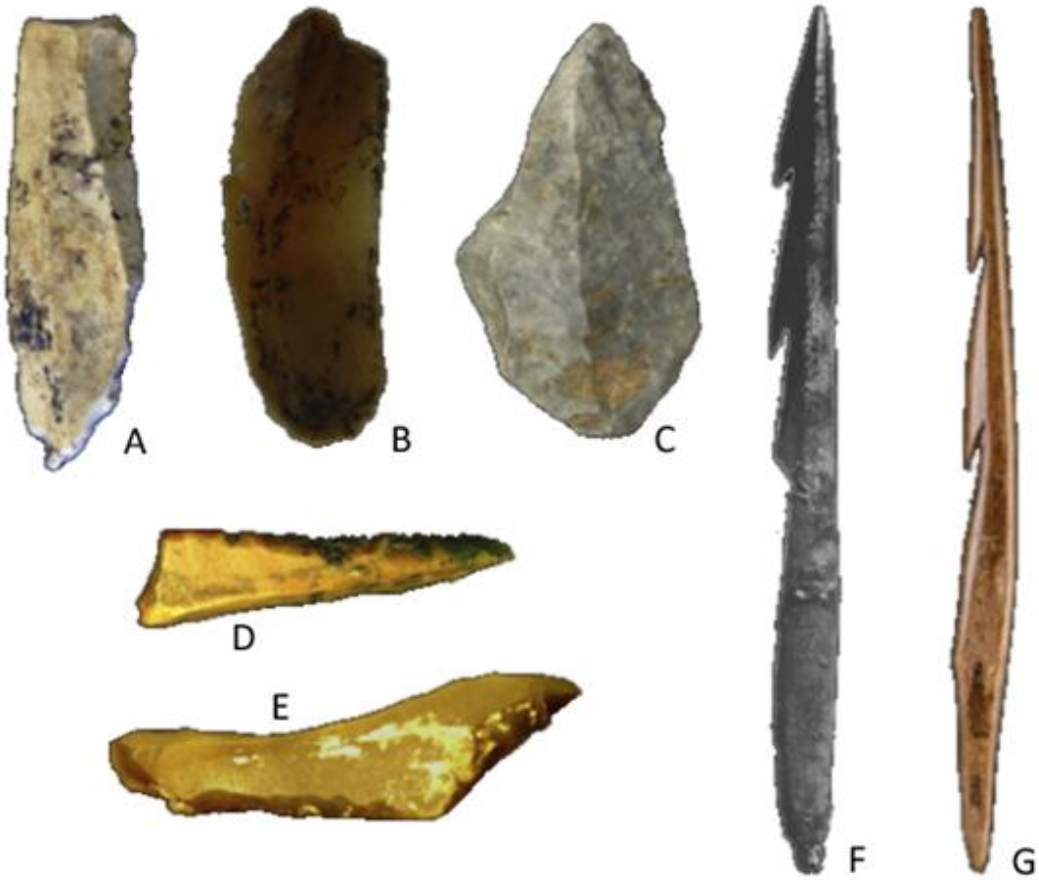


Figure 3. Upper Palaeolithic hafting adhesives: (A) birch tar from Les Vachons, (B) bitumen from Gura Cheii-Râşnov, (C) resin from Cueva Morín, (D and E) differently-coloured plaster residues from Ohalo II, (F) conifer tar from Gransmoor and (G) beeswax from Bergkamen (Baales, Birker and Mucha, 2017: Fig. 2; Bradtmöller *et al.*, 2016: Fig. 2; Yaroshevich, Nadel and Tsatskin, 2013: Fig. 6; Cârciumaru *et al.*, 2012: Fig. 2; Dinnis, Pawlik and Gaillard, 2009: Fig. 3; Sheldrick *et al.*, 1997: Fig. 6).

Upper Palaeolithic contexts further attest use of beeswax as a binder for thermally-altered goethite used to paint anthropomorphic figures on four large stones unearthed at Riparo Dalmeri, an Epigravettian site in Italy (Rosanó and Pellizzaro, 2005). Additional evidence of beeswax usage has been detected at Riparo di Villabruna, with GC-MS analysis conducted by Oxilia *et al.* (2015) identifying organic material packed into a decayed tooth as a beeswax filling – with a lump of Propolis resin mixed with beeswax attested in the same burial (Orscheidt, 2018; Giacobini, 2007).

2.2: Mesolithic Adhesives

A considerable body of evidence exists demonstrating Mesolithic adhesive use in hafting contexts. However, a large part of this evidence derives from microscopic analysis of lithic collections rather than chemical analysis of identified residues. Preserved wooden arrows have been discovered in Scandinavian bog sites – Larsson (2007) identified two fragmentary arrows hafted with adhesive at Lilla Loshults Mosse, Sweden and Larsson and Sjöström (2017) employed GC-MS to identify birch tar adhesive used to fix microliths into the sides of a preserved wooden arrowshaft (Figure 4) from nearby Rönneholms Mosse. Cristiani, Pedrotti and Gialanella (2009) detected use of bitumen mixed with beeswax via EDXS and ATR-FT-IR on 27 lithics from both the Mesolithic and Neolithic levels of Riparo Gaban, Italy indicating continuity in adhesive production between groups in both periods, with implications for regional Neolithization. Microscopic analysis detected unidentified adhesive residues at two Czech rock shelters (Hardy, 1999) and wood tar adhesive used to haft flint arrowheads at several Lithuanian sites (Rimkus, 2018). Vahur, Kriiska and Leito (2011) employed micro-ATR-FT-IR spectroscopy to detect birch tar residues mixed with animal fat and possible fir resin (Figure 4) on a flint blade from Pulli, Estonia with similar mixtures present as adhesive lumps. Zhilin (2018; 2017a; 2017b) and Zhilin and Matiskainen (2002) investigated dark grey residues via microscopic analysis of composite bone points bearing flint inserts from Ivanovskoye 7 and Stanovoye 4 in Russia – detecting two types of glue, probable plain conifer resin and a probable mixture of conifer resin with beeswax and charcoal. Several Late Epipalaeolithic sites in the Near East provide hafting evidence, with bitumen visually identified on a chert blade from Shanidar, Iraq (Solecki, 1963) and on two sickle blades from Gilgal I, Palestine (Dag and Goring-Morris, 2010). More detailed microscopic analyses detected lime plaster residues on a handful of tools from Saflulim, Israel and ochre on 120 different lithics from Tor Hamar (Goring-Morris *et al.*, 1999; Henry and Garrard, 1988).

Mesolithic peoples also used adhesives for other purposes, such as in architecture, decoration and repairing objects. The earliest evidence of plaster use in architecture, alongside hafted tools, is attested from the Natufian of the Levant dating to about 12-14,000 BP – with Friesem *et al.* (2019) noting use of lime plaster to line eight burial pits at Nahal Ein Gev II, Israel and Garrard and Yazbeck (2013) reporting a stone bin fixed to a floor using lime plaster at Moghr el-Ahwal, Lebanon. Petersen (2021) reports probable birch tar applied to a break as well as two additional boreholes on the neck of an amber elk figurine from Egemarke, The Netherlands and Iršėnas *et al.* (2018) detected resin forming the shape of an eye on an apparently incomplete elk antler staff from Šventoji 3 engraved with zoomorphic designs (Figure 4), either as paint or to sketch out unfinished engravings. Bocquentin and Garrard (2016) note possible bitumen strips painted over other coloured elements of a human cranium at the Natufian site of Azraq 18, Jordan. A limited number of adhesives have also been detected on late Mesolithic pottery from the Baltic region, although their purpose often remains unclear. Waterproofing is suggested by a variety of studies. Traces of a conifer product (tar or resin) were identified on potsherds from Šventoji 4 and Oulu Vepsänkangas (Papakosta and Pesonen, 2019; Heron *et al.*, 2015). Beeswax traces on another amphora with beeswax traces might have derived from waterproofing or storage (Heron *et al.*, 2015). Huseby Klev in Sweden attests clearer traces of waterproofing or sealing of containers. Lumps of chemically-identified birch tar bore impressions from twigs and/or twisted cordage interpreted as plant-based containers sealed to make them waterproof or protect their contents from pests (Kjellström *et al.*, 2010).

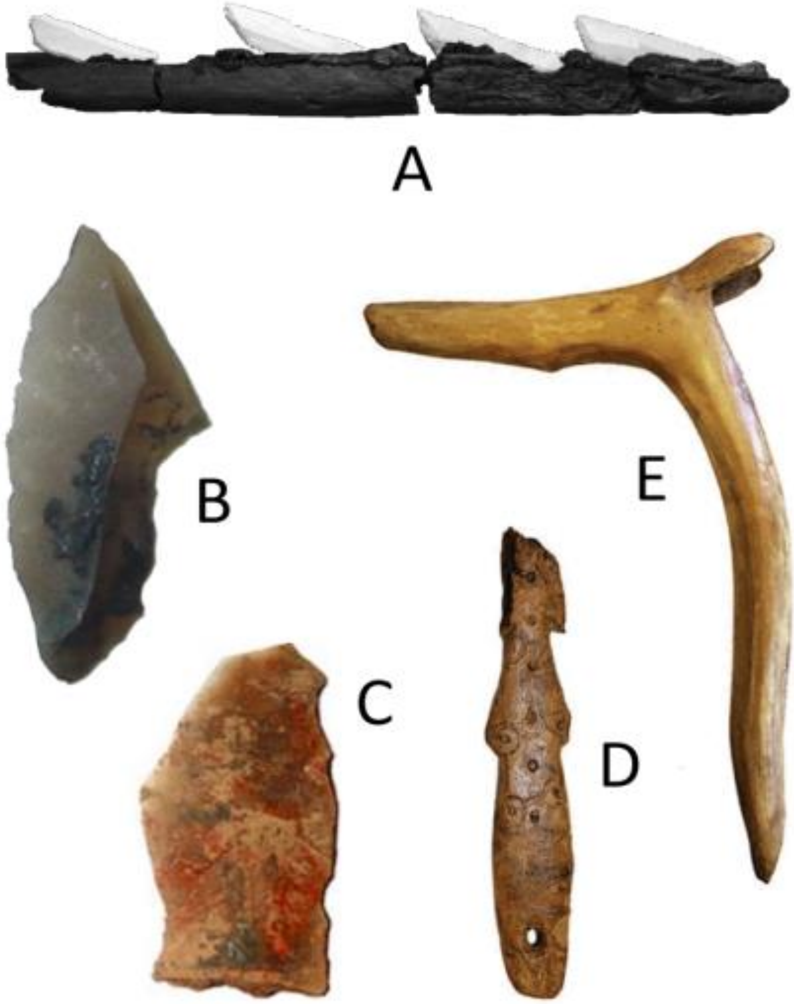


Figure 4. Mesolithic adhesive evidence: (A) birch tar fixing flint microliths at Rönneholms Mosse, (B) adhesive-bearing microlith from Pulli, (C) conifer resin mixtures present on a blade from Dvoinaya Cave, (D and E) resin applied to engraved objects from Šventoji (Iršėnas *et al.*, 2018: Figs. 9 and 11; Larsson, Sjöström and Heron, 2017: Fig. 3; Alexandrova, Kireeva and Leonova, 2014: Fig. 9; Vihur, Kriiska and Leito, 2011: Fig. 1).

The same site provides evidence of adhesive production, with fragments of birch bark adhering to the bases of tar lumps, suggesting a layering used to collect liquid adhesive to avoid soil contamination (Kjellström *et al.*, 2010). Adhesive-coated pebbles noted at Star Carr are also plausibly remnants of adhesive production/processing and a roll of birch bark wrapped around a pebble and clay core at the retooling site of Henauhof-Nord II, Germany is seen as reflecting tar production methods (Croft *et al.*, 2018; Pawlik and Thissen, 2011; Pawlik, 2004; Clark, 1954; Clark *et al.*, 1950). Birch tar lumps bearing tooth impressions, largely from Scandinavian sites, have prompted debate whether these represent chewing for adhesive preparation (softening/moistening for easier application or biting to size) or medicinal/hygienic reasons (Micheli *et al.*, 2018; Mökkönen and Nordqvist, 2017; van Gijn, 2008; Pesonen, 1999; 1996). Studies into pre-Neolithic population genetics and health focusing on human and viral DNA extraction have utilised such chewed adhesives (Jensen *et al.*, 2019; Kashuba *et al.*, 2019). Birch tar lumps have also provided indication of their use in caulking boats - Kjellström *et al.* (2010) found impressions of reeds or large axe-worked wooden objects on one side of eighteen thin pieces of adhesive material examined from Huseby Klev.

2.3: Neolithic Adhesives

Neolithic sites have yielded greater quantities of adhesive evidence than earlier periods, with traces of hafting adhesives particularly prominent – in Europe these consist largely of birch tar adhering to tools unearthed at waterlogged sites such as Egolzwil 3 and Sutz-Lattigen Aussen (Rimkus, 2018; Wojtczak and Kerdy, 2018; Gibaja *et al.*, 2017; Rück 2001). One particularly well-preserved example from Cham-Elsen, Switzerland was described by Gross-Klee and Hochuli (2002) who noted additional birch tar affixing strips of white birch bark to its haft (Figure 5). Alongside tar residues, Palomo *et al.* (2011) identified a sickle blade fixed into its preserved haft with pine resin at La Draga, Spain and Nardella *et al.* (2019) conducted geochemical analysis via GC-MS of bitumen residues adhering to a number of lithics and ceramic sherds from Southern Italian sites to determine their origin from nearby sources. Near Eastern sites like Tell Kaskashok or Tell Halula, as well as Mehrgarh in Pakistan, have yielded a number of lithics (especially sickle blades) bearing black residues visually identified as bitumen in the absence of widespread chemical analysis (Nishiaki, 2018; Borrell and Stefanisko, 2016; Khalaily, Milewski and Barzilai, 2013; Dag and Goring-Morris, 2010; Borrell and Molist, 2007; Jarrige, 2006; Copeland and Verhoeven, 1996; Bader, 1993; Vaughan, 1987). In the case of Tell Halula, Borrell and Stefanisko (2016) identified an apparent differential usage of hafting adhesives, with bitumen employed on sickle blades to allow easy replacement and lime plaster on arrowheads to easily detach them on impact. In addition to residues adhering to lithic or osseous materials, spectroscopic examination of a preserved yew wood bow from Parkhaus Opera, Switzerland by Bleicher *et al.* (2015) identified animal hide glue backing it with strips of cherry bark (Figure 5) and GC-MS analysis by Wu *et al.* (2018) of a Mulberry wood bow from Kuahuqiao, China detected use of Toxicoendron lacquer in its coating. GC-MS analysis of a mixture packed into a cavity on a human tooth indicated application of beeswax mixed with animal fat to the body as a filling in a burial at Lonche, Slovenia (Bernardini *et al.*, 2012).

Plaster use increases massively beyond hafting in the Neolithic – largely in the Near East – with house interiors at Abu Hureyra, Çatalhöyük and Ulucak Höyük coated with mud plaster replenished seasonally, with multiple layers building up over the use-life of a house (Erol, 2019; Anderson, Almond and Matthews, 2014; Çilingiroğlu *et al.*, 2004; Kopelson, 1996; Kingery, Vandiver and Pickett, 1988). Microscopic, FT-IR and XRD analyses of plaster samples from Çatalhöyük by Anderson, Almond and Matthews (2014) indicated use of coarser brown plasters to provide an initial coat before a finer white finishing layer was applied. Lime plaster was used to construct elaborate and highly individualised anthropomorphic statues at Ain Ghazal (Figure 5) and other sites, plastered around a core of reed bundles held together by cordage and ornamented with bitumen applied to represent the eyes (Rollefson, 2002; Grissom, 2000; Rollefson, 1983). Lime plaster was also applied to skulls recovered in caches from other PPNB sites in the Near East like Jericho and Yiftahel, with features modelled to represent the deceased (Slon *et al.*, 2014; Schmandt-Besserat, 2013; Khalaily, Milevski and Barzilai, 2013; Milevski *et* *al.*, 2008; Goren, Goring-Morris and Segal, 2001; Hershkovitz *et al.*, 1995; Kingery, Vandiver and Noy, 1992).

Figure 5. Neolithic tools and plaster objects: (A) plastered skull from Kfar HaHoresh, (B) plaster sculpture from ‘Ain Ghazal with bitumen-painted eyes, (C) cherry bark glued onto a wooden bow from Parkhaus Opera, (D) ochreous clay plaster used for hafting at Gesher, (E) lime plaster adhering to a blade from Tell Halula and (F) preserved hatchet bearing birch tar residues from Cham-Elsen (Borrell and Stefanisko, 2016: Fig. 5; Bleicher *et al.*, 2015: Fig. 1; Schmandt-Besserat, 2013: Plate 7.3.1.D; Shaham, Grosman and Goren-Inbar, 2010: Fig. 1; Gross-Klee and Hochuli, 2002: Fig. 26; Hershkovitz *et al.*, 1995: Fig. 2).

The development of pottery provides a crucial and more durable source of evidence for adhesives used for a wide variety of purposes (Urem-Kotsou *et al.*, 2018; Kabaciński *et al.*, 2015; Mirabaud *et al.*, 2015; Šoberl *et al.*, 2014; Marangou and Stern, 2009; Mitkidou *et al.*, 2008; Urem-Kotsou *et al.*, 2002; McGovern *et al.*, 1996). Elburg and Stäuble (2011) describe a pottery vessel from Altscherbitz, Germany repaired with cord passed through two holes stopped up with tar before the whole exterior was covered with additional tar (Figure 6) and Mirabaud *et al.* (2015) employed GC-MS to identify birch tar applied directly to the edge of breaks to repair vessels at Clairvaux, France. Pine resin detected on the interior of ceramic vessels at Bylany, Czechia and Zambujeiro, Portugal implied waterproofing or their processing for other uses (Matlova *et al.*, 2017; Manhita *et al.*, 2014). Infrequent traces of beeswax detected in ceramic vessels by lipid analysis likely derive from food processing or storage/processing rather than waterproofing, as experiments conducted by Šoberl *et al.* (2014) indicate beeswax is poorly suited for this purpose due to its tendency to flake off and damage the pot fabric (Drieu *et al.*, 2020; Stojanovski *et al.*, 2020; Urem-Kotsou *et al.*, 2018; Roffet-Salque *et al.*, 2015; Regert *et al.*, 2001; Heron, Nemcek and Bonfield 1994; Needham and Evans 1987). Studies conducted at Makriyalos 1, Paliambela and Stavroupoli in Greece by Urem-Kotsou *et al.* (2018) and Mitkidou *et al.* (2008) identified varied use of adhesives in repairing and waterproofing vessels with birch/pine tar and pine resin detected via GC-MS analysis. These differ from most Neolithic studies in assessing differences in adhesive technologies between sites within a set region, as opposed to an individual site. GC-MS analysis by Rageot *et al.* (2021) of residues from sixteen Neolithic sites in the Northwestern Mediterranean proved a similarly fruitful approach to assessing broader developments in Neolithic adhesive usage.

Interpretation of vessels containing potential adhesive substances is contextually problematic. Resins presenting alongside grape residues indicative of wine have been seen as suggestive of resination to prevent bacterial growth and spoiling in a practice similar to modern-day retsina – yellowish residues on the interior of a vessel (Figure 6) from Hajji Firuz Tepe, Iran were identified by McGovern *et al.* (1996) as Pistacia resin alongside tartaric acid indicating wine. Containers bearing birch tar residues on interior surfaces (Figure 6) have been interpreted as incense burners used to mask decomposition odours due to their presence at funerary sites or directly in burials (Šoberl *et al.*, 2014; Lucquin, March and Cassen, 2007).

Figure 6. Pottery vessels/sherds bearing adhesive residues: (A) jar from Hajji Firuz Tepe bearing Pistacia resin from wine resination, (B) vessel from Altscherbitz repaired with birch tar and cord, (C) birch tar waterproofing a sherd from Rożniaty, Poland, (D) pot repaired with birch tar (black residue) from Lešany, Czechia and (E) birch tar adhering to a sherd from Moverna

vas, Slovenia (Penn Museum, 2020; Kabaciński *et al.*, 2015: Fig. 11; Šoberl *et al.*, 2014: Fig. 10; Elburg and Stäuble, 2011: Fig. 141; Prokeš *et al.*, 2009-2010: Fig. 4).

Considerable evidence is also available for decoration of pottery using bitumen or birch tar adhesives, either directly as paints or fixing decorations in place. Much consists of adhesives applied to cover existing incised decorations to form a new exterior surface, as demonstrated via microscopic analysis by Kabaciński *et al.* (2015) at sites in Eastern Europe and Saile, Sedlmaier and Dębiec (2018) at Rovantsi in Ukraine. Alakbarov (2018; 2015) highlights use of bitumen to paint black bands around the rims of some vessels at Göytepe, Azerbaijan. In some instances, birch tar was also applied to fix birch bark or shell decorations to the sides of vessels, with Goldman and Szénászky (2003) also noting use of bitumen to apply well-preserved strips of birch bark to vessels at Zsadány-Püski-Hügel, Hungary. Beads and ornaments were also decorated with adhesives - FTIR and RS analysis of a pierced amber disk from Daktariske 5, Lithuania identified a black mixture of pine resin, beeswax and charcoal filling engraved pits and two stone beads from La Molina, Spain were coated with pine resin, likely in imitation of amber beads (Odriozola Lloret *et al.*, 2020; 2019; Butrimas, 2018; 2016). Evidence for use as a pigment binder remains limited compared with earlier periods – Rampazzi *et al.* (2007) detected egg glues mixed with conifer resin used in some instances to bind haematite and carbon black to paint geometric motifs in Sardinian tombs.

Reed and barnacle impressions on opposite sides of thin bitumen lumps from late Neolithic Near Eastern sites have been interpreted as caulking applied to reed-bundle boats (Connan and Carter, 2007; Connan *et al.*, 2005; Carter and Crawford, 2003). Connan *et al.* (2005) report 77 such bitumen slabs in caches in a storage building at H3, Kuwait with GC-MS geochemical analysis determining their origin from Mesopotamia either as raw material or caulking already fixed to boats. Reed and cordage impressions on bitumen and plaster fragments elsewhere in the Middle East have been interpreted as coatings applied to seal plant-based containers, either to waterproof them or as sealant to prevent pests from accessing their contents (Van de Velde, 2015b; Molist *et al.*, 2013; Gregg, Bretell and Stern, 2007; Copeland and Verhoeven, 1996; Bader, 1993; Moore, 1978).

2.4: Bronze and Iron Age Adhesives

More limited evidence for hafting adhesives is present from later prehistory compared with the Neolithic period, especially from the Iron Age which only attests a single prominent example. Birch tar mixed with animal fat was employed at Argancy to fix a bronze sword into its haft and FTIR analysis of stone slabs and two lithics from Bronze Age sites in Romania detected bitumen residues (Cosac *et al.*, 2013; Regert *et al.*, 2004). Callanan (2014) reports unidentified wood tar fixing shell and antler arrowheads to preserved hafts found in ice patches in Norway. More widespread evidence of Bronze Age hafting adhesives is present in the Near East, with bitumen use attested through microscopic analysis of Canaanean-type sickle blades likely fixed into threshing sledges at dozens of sites in Syria and Iraq (Manclossi, Rosen and Milevski, 2019; Manclossi, Rosen and De Miroschedji, 2016; Milevski *et al.*, 2013; Chabot and Eid, 2007; Chabot and Van Gijn, 2004; Anderson and Chabot, 2001). As well as bitumen, evidence of bone collagen hafting adhesives is attested through SEM-EDS analysis by Yaroshevich (2019) of a sickle blade from Or Yehuda, Israel and preliminary chemical analyses by Manclossi, Rosen and Lehmann (2018) suggest use of a gypsum plaster in hafting various sickle blades (Figure 7) at the early Iron Age site of Qubur el-Walaydah, Israel. Pure lime plaster is also attested on two Eighteenth-Dynasty sickle blades unearthed at Tell el Dab’a, Egypt (Endlicher and Tillmann, 1997).

Extensive adhesive evidence is derived from ceramic analysis. Analysis of ceramics from various Bronze and Iron Age sites by Regert *et al.* (2004) identified the presence of birch tar waterproofing or repairing a number of vessels (Figure 7), in some cases mixed with beeswax at Grand Aunay. Limited evidence is present for resin use in later prehistory – one sample from Bronze Age La Fangade attested pine resin likely used in waterproofing (Regert *et al.*, 2004). Rageot *et al.* (2016) identified differential use of tar adhesives in repairing and waterproofing vessels at Cuciurpula, France with pure birch tar alone used in repairing while pine tar and altered birch tar containing beeswax or pine resin was only utilised in waterproofing vessels. Adhesives were also utilised in gluing decorative elements to ceramic vessels and ornaments – Morandi, Porta and Ribechini (2018) employed GC-MS to identify birch tar gluing metal strips to the surface of a Bronze Age funerary urn from Vetulona, Italy. Further evidence of tars used in waterproofing is attested from the Iron Age site of Vix-Mont Lassois, with birch and pine tars sealing or resinating thirteen amphorae containing wine and other products (Rageot *et al.*, 2019). Ballard *et al.* (2002) also notes Iron Age use of pine tar to waterproof amphorae recovered from the Tanis, a shipwreck off the coast of Israel.

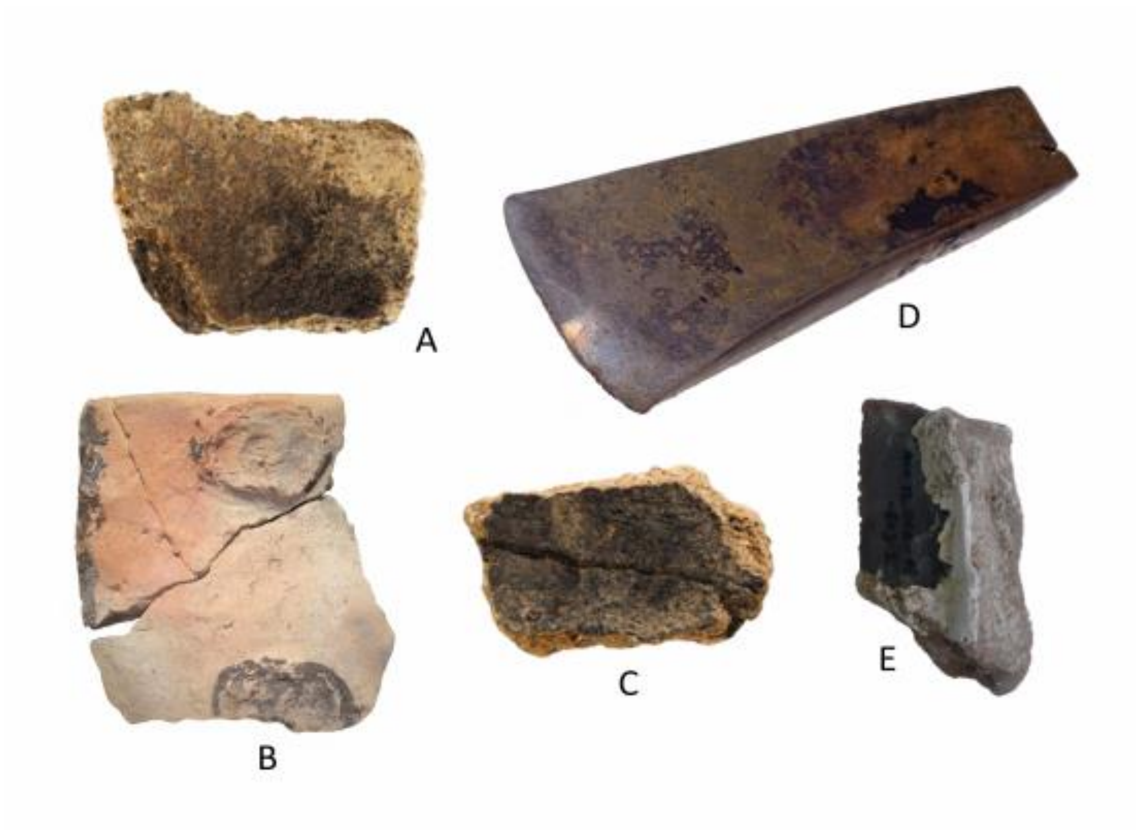


Figure 7. Bronze Age adhesives applied to lithics, metal tools and pottery: (A) birch tar waterproofing a sherd from Cuciurpula, (B) birch tar repairing the handle of a vessel from Coste di Santa Febronia, (C) birch tar repairing a sherd from Cuciurpula, (D) birch tar hafting a copper hatchet used by Otzi, (E) thick layer of gypsum plaster hafting a flint tool from Qubur el-Walaydah (Manclossi, Rosen and Lehmann, 2018: Fig. 14; Mentesana, De Benedetto and Fiorentino, 2018: Fig. 2; Artioli *et al.*, 2017: Fig. 1; Rageot *et al.*, 2015: Fig. 2).

Ample evidence exists for the transportation of adhesives in later prehistory – GC-MS analyses identified pure Pistacia resin in a large quantity of amphorae recovered from a Bronze age shipwreck at Uluburun, Turkey without trace of wine-derived tartaric or syringic acids (Mills and White, 1989; Stern *et al.*, 2009). Evidence of adhesive processing is evident in some ceramics, with Schwartz and Hollander (2000) noting bitumen residue concentrated near jug spouts and congealing down the side of a bowl indicating pouring and transporting or processing of liquid bitumen in the early Bronze Age at Hacinebi Tepe, Turkey. Better organic preservation has left traces of wooden boats bearing adhesive residues from both the Bronze and Iron Ages. Tejedor (2018) and Negueruela (2004) note pine tar caulking of two Iron Age ships from Mazarron, Spain, and Connan and Nissenbaum (2003) identify conifer tar applied to the exterior of the Ma'agan Mikhael ship from Israel. However, other preserved wooden boats have been found lacking adhesive residues, being luted with wooden shavings, fabric or strips of bark in lieu of adhesive substances (Arnold, 1977). Lumps of pure bitumen bearing reed and barnacle impressions originating from Northern Iraq unearthed at Bronze Age Ra's al-Jinz in Oman have been interpreted as caulking applied to reed-bundle boats, as noted in the preceding Neolithic (Connan *et al.*, 2005).

Medicinal use of adhesives is suggested in the early Bronze Age by Baczyńska and Lityńska-Zając (2005) from a lump of unidentified wood tar fixed to the remains (nutlets) of a common gromwell fruit (Figure 8) found in the grave of a woman from Szarbia 14 in Poland. It was interpreted as a medicinal plaster from the pharmaceutical properties of both the tar and the fruit (Baczyńska and Lityńska-Zając, 2005).

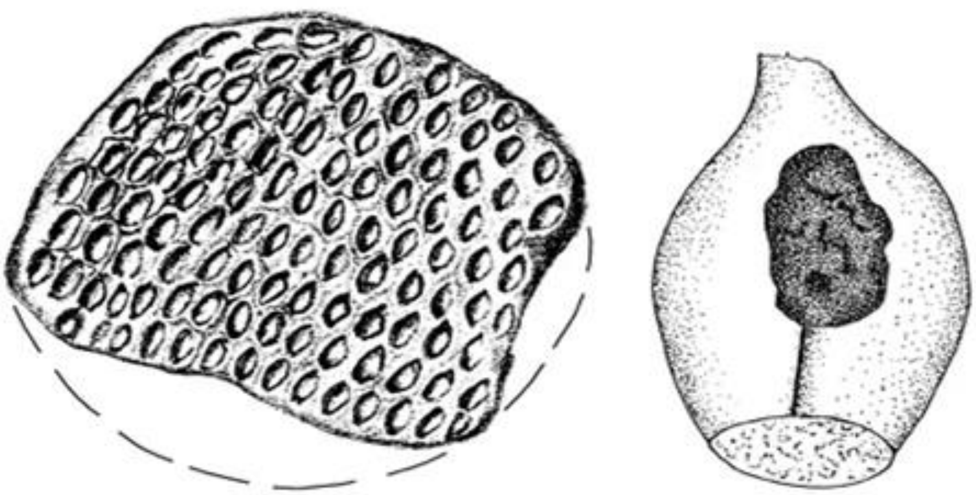


Figure 8. Illustration of a possible medicinal plaster from Szarbia 14, bearing impressions of gromwell nutlets (Baczyńska and Lityńska-Zając, 2015: Fig. 2).

2.5: Summary

A brief evaluation of prehistoric adhesive evidence indicates a major problem – research is principally site-based, focusing on expanding knowledge of cultural choices, specific technological processes, and resource procurement at individual sites via detection or identification of adhesive residues. However, an increasing number of Neolithic and Bronze/Iron Age studies have taken a broader approach to assessing adhesive use, examining differences in production, procurement and use across multiple sites to evaluate wider cultural and temporal differences. Middle Palaeolithic research, however, differs in focusing on adhesives as a proxy for assessing Neanderthal and early *Homo sapiens* cognition and behaviour before the Upper Palaeolithic symbolic revolution in light of increasing evidence of behavioural modernity in earlier periods. In MSA research, adhesives themselves are secondary to the symbolic or technological implications of ochre aggregate included in adhesive mixtures. Adhesives also act as a proxy for assessing behaviour in Upper Palaeolithic research conducted in areas outside the main focus of research - in the absence of sufficient data from these regions, adhesive usage has been explored to shed further light on behavioural modernity. However, the broadly site-based nature of research overall hinders assessment of wider adhesive usage, even within a set period – greater synthesis of site data, as this thesis attempts, is needed to evaluate shifts in adhesive utilisation across periods.

Although adhesive evidence consists entirely of hafting residues in the Middle Palaeolithic, it broadens somewhat in the Upper Palaeolithic and Mesolithic with evidence of chewed tar, adhesive paint binders and possible medicinal usage emerging. Evidence diversifies further in the Neolithic period, with increased evidence for repairs, waterproofing and other roles attested on pottery vessels and heavier use of adhesive plasters utilised in architecture and ritual practices. Little definitive evidence is available for adhesive production, with traces on pottery often unclear and potentially resulting from other roles. From a cursory examination, birch tars and bitumen would appear to be the principal adhesives of choice across the entirety of prehistory. Bitumen and mud/lime plasters appear to be utilised more heavily in Near Eastern contexts, while European contexts seem to make use of a somewhat broader range of adhesives (pine tar, pine resin, beeswax) although birch tar still predominates. Elsewhere in the world, heavy use appears to be made of resins and gums over bitumen or tar adhesives. However, the accuracy of these assumptions may be flawed due to limited regional synthesis and critiquing factors, such as experimental or ethnographic data, should be employed to further evaluate the validity of the archaeological record.

3: Methods

This chapter outlines the approaches taken to achieve the study objectives – construction of a site database to facilitate production of charts/maps outlining archaeological continuities and differences, alongside experiments evaluating adhesive performance in critique of the archaeological record. In the latter instance, this necessitated manual production of certain glues to obtain accurate results.

3.1: Database Construction

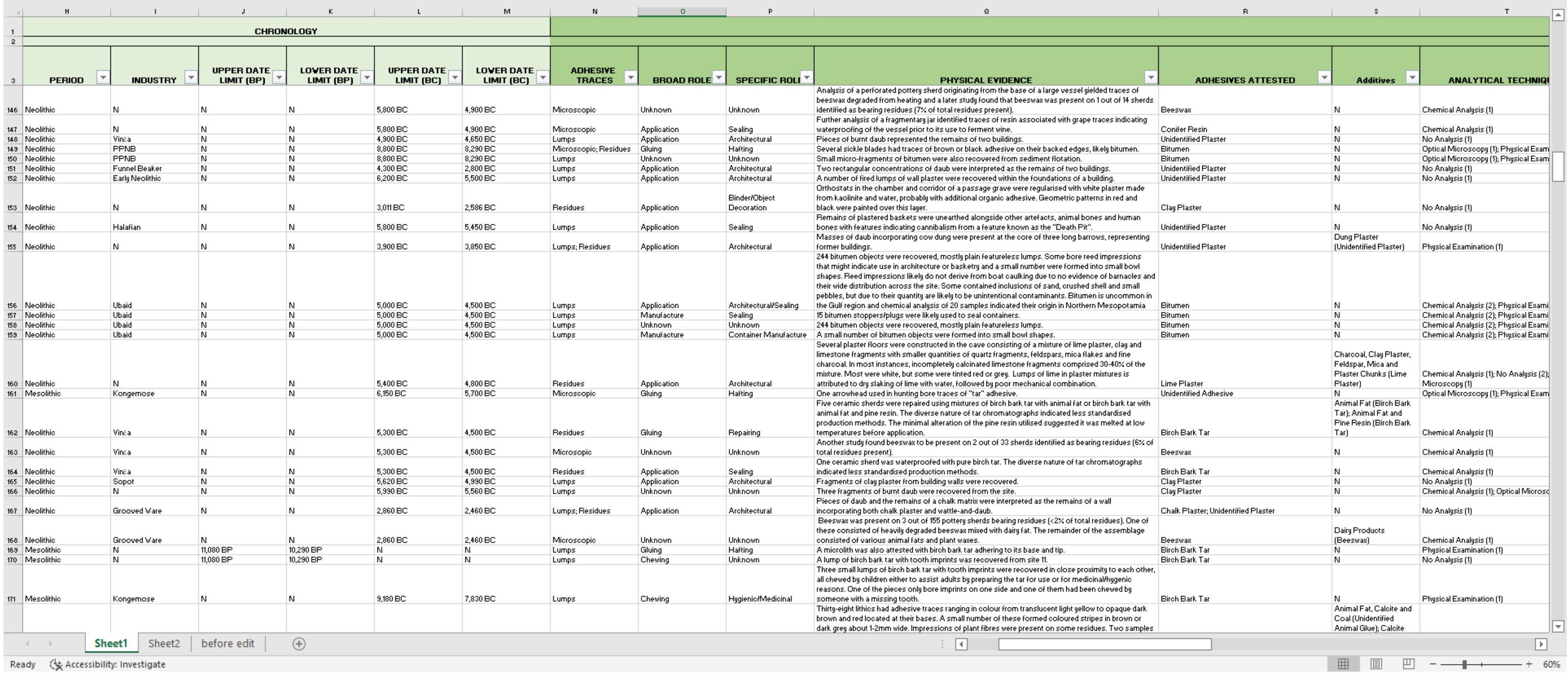
A database of archaeological evidence for adhesive usage and production was constructed in Microsoft Excel (see Appendices 1 and 2) to enable the consolidation of site information into an easily interpretable form and assist production of charts in Excel and maps in ArcGIS to illustrate discussion points. Search entries consisted of general terms ("adhesive" / "glue" / "resin") in combination with a period ("Mesolithic glue") as well as their equivalents in a number of other languages (Table 2). Relevant portions of foreign-language sources were translated into English using Google Translate. Database scope was limited to Late Epipalaeolithic/Mesolithic and Neolithic sites from Europe and the Near East, categorised according to the UN geoscheme system for subdividing global regions – with two exceptions. Siberia was excluded from Eastern Europe and sites from Iran (classified as Southern Asia) were included in analysis of Near Eastern data.

Each database consisted of rows presenting distinct information categories (site name, period, etc.) for each site in a columnar format (Figure 9). The papers utilised to provide site information were noted and coordinates added for use in creating maps of adhesive prevalence/distribution. Site dating was laid out in two columns to differentiate BC/BP dates - if dates or coordinates were not provided within the source paper(s) these were obtained from elsewhere and if no direct dating or map coordinates were available, the location of the nearest village/feature and general dates for industries (if noted) were employed instead. Dates which did not directly derive from the site in question were italicised. The nature of adhesive evidence present was recorded, with separate columns listing materials on which adhesive was present, roles adhesives played, evidence of production/processing and specific adhesives identified. Adhesive uses were characterised both broadly – application, gluing, chewing – and specifically – architectural, hafting, object decoration. In the case of two broader categories, some further clarification is needed – application relates to placement of adhesives onto a surface, whereas manufacture relates to moulding of adhesive material itself (rather than any other object) to produce solid objects. The extent of analysis supporting interpretations was evaluated by recording analytical techniques employed in research, with each technique followed by a number paired with a specific research paper (e.g., Optical Microscopy (2; 4)) to demonstrate what paper utilised which technique. Chemical analysis refers to chemical/microscopic techniques used to identify adhesives, with optical microscopy and physical examination referring to purely visual examination of adhesives. No analysis comprises mention of adhesives at a site without any detailed examination. Different entries in a column were separated by a semi-colon for extra clarity while differing interpretations of adhesive use or industry attribution were linked by use of a forward slash.

Periods Searched	Terms Utilised	Foreign Languages Searched In
Epipalaeolithic	Adhesive	Arabic
Epipaleolithic	Aloe	Bulgarian
Mesolithic	Asafoetida	Czech
Neolithic	Beeswax	Danish
	Bitumen	Dutch
	Caesin	Estonian
	Daub	Finnish
	Frankincense	French
	Glue	German
	Gum	Greek
	Labdanum	Hungarian
	Latex	Italian
	Mastic	Latvian
	Mucilage	Lithuanian
	Myrrh	Norwegian
	Plaster	Persian
	Pitch	Polish
	Resin	Portuguese
	Rosin	Romanian
	Sandarac	Russian

Storax	Spanish
Styrax	Swedish
Tar	Turkish
Wax	Ukrainian

Table 2. Search terms employed when gathering research papers for database use.



	PERIOD	INDUSTRY	UPPER DATE LIMIT (BP)	LOWER DATE LIMIT (BP)	UPPER DATE LIMIT (BC)	LOWER DATE LIMIT (BC)	ADHESIVE TRACES	BROAD ROLE	SPECIFIC ROLI	PHYSICAL EVIDENCE	ADHESIVES ATTESTED	Additives	ANALYTICAL TECHNIQU
	CHRONOLOGY												
146	Neolithic	N	N	N	5,800 BC	4,900 BC	Microscopic	Unknown	Unknown	Analysis of a perforated pottery sherd originating from the base of a large vessel yielded traces of beeswax degraded from heating and a later study found that beeswax was present on 1 out of 14 sherds identified as bearing residues (7% of total residues present).	Beeswax	N	Chemical Analysis (1)
147	Neolithic	N	N	N	5,800 BC	4,900 BC	Microscopic	Application	Sealing	Further analysis of a fragmentary jar identified traces of resin associated with grape traces indicating waterproofing of the vessel prior to its use to ferment wine.	Conifer Resin	N	Chemical Analysis (1)
148	Neolithic	Vinča	N	N	4,900 BC	4,650 BC	Lumps	Application	Architectural	Pieces of burnt daub represented the remains of two buildings.	Unidentified Plaster	N	No Analysis (1)
149	Neolithic	PPNB	N	N	8,800 BC	8,290 BC	Microscopic; Residues	Gluing	Hafting	Several sickle blades had traces of brown or black adhesive on their backed edges, likely bitumen.	Bitumen	N	Optical Microscopy (1); Physical Exam
150	Neolithic	PPNB	N	N	8,800 BC	8,290 BC	Lumps	Unknown	Unknown	Small micro-fragments of bitumen were also recovered from sediment flotation.	Bitumen	N	Optical Microscopy (1); Physical Exam
151	Neolithic	Funnel Beaker	N	N	4,300 BC	2,800 BC	Lumps	Application	Architectural	Two rectangular concentrations of daub were interpreted as the remains of two buildings.	Unidentified Plaster	N	No Analysis (1)
152	Neolithic	Early Neolithic	N	N	6,200 BC	5,500 BC	Lumps	Application	Architectural	A number of fired lumps of wall plaster were recovered within the foundations of a building.	Unidentified Plaster	N	No Analysis (1)
153	Neolithic	N	N	N	3,011 BC	2,586 BC	Residues	Application	Binder/Object Decoration	Orthostats in the chamber and corridor of a passage grave were regularised with white plaster made from kaolinite and water, probably with additional organic adhesive. Geometric patterns in red and black were painted over this layer.	Clay Plaster	N	No Analysis (1)
154	Neolithic	Halafian	N	N	5,800 BC	5,450 BC	Lumps	Application	Sealing	Remains of plastered baskets were unearthed alongside other artefacts, animal bones and human bones with features indicating cannibalism from a feature known as the "Death Pit".	Unidentified Plaster	N	No Analysis (1)
155	Neolithic	N	N	N	3,900 BC	3,850 BC	Lumps; Residues	Application	Architectural	Masses of daub incorporating cow dung were present at the core of three long barrows, representing former buildings.	Unidentified Plaster	Dung Plaster (Unidentified Plaster)	Physical Examination (1)
156	Neolithic	Ubaid	N	N	5,000 BC	4,500 BC	Lumps	Application	Architectural/Sealing	244 bitumen objects were recovered, mostly plain featureless lumps. Some bore reed impressions that might indicate use in architecture or basketry and a small number were formed into small bowl shapes. Reed impressions likely do not derive from boat caulking due to no evidence of barnacles and their wide distribution across the site. Some contained inclusions of sand, crushed shell and small pebbles, but due to their quantity are likely to be unintentional contaminants. Bitumen is uncommon in the Gulf region and chemical analysis of 20 samples indicated their origin in Northern Mesopotamia	Bitumen	N	Chemical Analysis (2); Physical Exami
157	Neolithic	Ubaid	N	N	5,000 BC	4,500 BC	Lumps	Manufacture	Sealing	15 bitumen stoppers/plugs were likely used to seal containers.	Bitumen	N	Chemical Analysis (2); Physical Exami
158	Neolithic	Ubaid	N	N	5,000 BC	4,500 BC	Lumps	Unknown	Unknown	244 bitumen objects were recovered, mostly plain featureless lumps.	Bitumen	N	Chemical Analysis (2); Physical Exami
159	Neolithic	Ubaid	N	N	5,000 BC	4,500 BC	Lumps	Manufacture	Container Manufacture	A small number of bitumen objects were formed into small bowl shapes.	Bitumen	N	Chemical Analysis (2); Physical Exami
160	Neolithic	N	N	N	5,400 BC	4,800 BC	Residues	Application	Architectural	Several plaster floors were constructed in the cave consisting of a mixture of lime plaster, clay and limestone fragments with smaller quantities of quartz fragments, feldspars, mica flakes and fine charcoal. In most instances, incompletely calcinated limestone fragments comprised 30-40% of the mixture. Most were white, but some were tinted red or grey. Lumps of lime in plaster mixtures is attributed to dry slaking of lime with water, followed by poor mechanical combination.	Lime Plaster	Charcoal, Clay Plaster, Feldspar, Mica and Plaster Chunks (Lime Plaster)	Chemical Analysis (1); No Analysis (2); Microscopy (1)
161	Mesolithic	Kongemose	N	N	6,150 BC	5,700 BC	Microscopic	Gluing	Hafting	One arrowhead used in hunting bore traces of "tar" adhesive.	Unidentified Adhesive	N	Optical Microscopy (1); Physical Exam
162	Neolithic	Vinča	N	N	5,300 BC	4,500 BC	Residues	Gluing	Repairing	Five ceramic sherds were repaired using mixtures of birch bark tar with animal fat or birch bark tar with animal fat and pine resin. The diverse nature of tar chromatographs indicated less standardised production methods. The minimal alteration of the pine resin utilised suggested it was melted at low temperatures before application.	Birch Bark Tar	Animal Fat (Birch Bark Tar); Animal Fat and Pine Resin (Birch Bark Tar)	Chemical Analysis (1)
163	Neolithic	Vinča	N	N	5,300 BC	4,500 BC	Microsopic	Unknown	Unknown	Another study found beeswax to be present on 2 out of 33 sherds identified as bearing residues (6% of total residues present).	Beeswax	N	Chemical Analysis (1)
164	Neolithic	Vinča	N	N	5,300 BC	4,500 BC	Residues	Application	Sealing	One ceramic sherd was waterproofed with pure birch tar. The diverse nature of tar chromatographs indicated less standardised production methods.	Birch Bark Tar	N	Chemical Analysis (1)
165	Neolithic	Sopot	N	N	5,620 BC	4,990 BC	Lumps	Application	Architectural	Fragments of clay plaster from building walls were recovered.	Clay Plaster	N	No Analysis (1)
166	Neolithic	N	N	N	5,990 BC	5,560 BC	Lumps	Unknown	Unknown	Three fragments of burnt daub were recovered from the site.	Clay Plaster	N	Chemical Analysis (1); Optical Microsc
167	Neolithic	Grooved Ware	N	N	2,860 BC	2,460 BC	Lumps; Residues	Application	Architectural	Pieces of daub and the remains of a chalk matrix were interpreted as the remains of a wall incorporating both chalk plaster and wattle-and-daub.	Chalk Plaster; Unidentified Plaster	N	No Analysis (1)
168	Neolithic	Grooved Ware	N	N	2,860 BC	2,460 BC	Microscopic	Unknown	Unknown	Beeswax was present on 3 out of 155 pottery sherds bearing residues (<2% of total residues). One of these consisted of heavily degraded beeswax mixed with dairy fat. The remainder of the assemblage consisted of various animal fats and plant waxes.	Beeswax	Dairy Products (Beeswax)	Chemical Analysis (1)
169	Mesolithic	N	11,080 BP	10,290 BP	N	N	Lumps	Gluing	Hafting	A microlith was also attested with birch bark tar adhering to its base and tip.	Birch Bark Tar	N	Physical Examination (1)
170	Mesolithic	N	11,080 BP	10,290 BP	N	N	Lumps	Chewing	Unknown	A lump of birch bark tar with tooth imprints was recovered from site 11.	Birch Bark Tar	N	No Analysis (1)
171	Mesolithic	Kongemose	N	N	9,180 BC	7,830 BC	Lumps	Chewing	Hygienic/Medicinal	Three small lumps of birch bark tar with tooth imprints were recovered in close proximity to each other, all chewed by children either to assist adults by preparing the tar for use or for medicinal/hygenic reasons. One of the pieces only bore imprints on one side and one of them had been chewed by someone with a missing tooth.	Birch Bark Tar	N	Physical Examination (1)
										Thirty-eight lithics had adhesive traces ranging in colour from translucent light yellow to opaque dark brown and red located at their bases. A small number of these formed coloured stripes in brown or dark grey about 1-2mm wide. Impressions of plant fibres were present on some residues. Two samples		Animal Fat, Calcite and Coal (Unidentified Animal Glue); Calcite	

Figure 9. Example of columns utilised in the archaeological database.

3.2: Experimental Overview

Adhesives were tested experimentally to assess their relative strength and performance in order to determine their likelihood of utilisation by prehistoric societies. Water resistance experiments complimented strength testing by assessing the viability of adhesives – while a glue might be very effective, its utility may be irretrievably compromised if it easily dissolves when exposed to rain or dropped into a body of water.

Adhesive strength would ideally have been assessed in a more controlled manner along the lines of previous experimental work, utilising a universal testing machine to conduct lap shear tests (Kozowyk, Poulis and Langejans, 2017; Kozowyk, Langejans and Poulis, 2016; Zipkin *et al.*, 2014). However, access to such machinery proved impossible due to the ongoing COVID-19 pandemic. Therefore, a more experiential approach was taken to determine relative adhesive performance by testing the capacity of flint blades hafted with each adhesive to withstand force. It was decided to test tool performance by sawing rather than impact testing, as a more qualitative measure of effectiveness could be determined by sawing while impact testing would necessitate a more complex methodology and larger tool set. Conversely, while prolonged exposure to rain might have proved a more actualistic approach to examining water resistance, this proved too complex to simulate in an experimental environment.

A broad range of adhesives were analysed to determine the likeliness of their use by Late Epipalaeolithic/Mesolithic and Neolithic societies – with a representative portion deriving from both Europe and the Near East examined (Table 3). These derived from a variety of natural sources – plant resins and latexes, wood tars, collagen glues, casein and albumin glues, bitumen and lime plaster – to name a few examples. The majority derive from both regions to some extent, although acacia/frankincense/myrrh are limited solely to Southern Arabia and sandarac to the Iberian Peninsula. A broader range of tars could have been analysed – especially some deriving from Near

Eastern species like cedar. However, tar or suitable quantities of raw bark from which to produce tar were only commercially available in suitable quantities for birch and pine bark tars to be assessed. Lack of commercial sources also excluded some other adhesives like cedar/fir and styrax resins from this study. While thousands of plant species that produce latex could potentially have been examined, this number was limited to two of the more easily procurable, with one deriving from each region (Lewinsohn, 1991). Each adhesive was assessed twice to permit a fuller assessment of its abilities – unaltered and as a compound adhesive with 25% plasticiser and 25% aggregate additives added. While previous research demonstrates small variations in these components can heavily impact adhesive strength, they were set at 25% each to provide an example of a heavily modified adhesive for comparative purposes (Kozowyk, Poulis and Langejans, 2017; Kozowyk, Langejans and Poulis, 2016; Zipkin *et al.*, 2014). The original adhesive comprised 50% of this mixture. Beeswax and powdered charcoal were added as plasticiser and aggregate additives respectively – available across both regions.

Experimental work was conducted at both a home address and experimental facilities at the University of York (the YEAR Centre and PalaeoHub) in early 2021. A risk assessment was completed (see Appendix 3) before work commenced – thick gloves and safety goggles were worn when sawing materials, producing/handling adhesives and tending to fires. Masks were worn at all times due to the ongoing COVID-19 pandemic, as well to deal with noxious fumes from bitumen processing. Additional precautions were taken to account for dealing with lime plaster production (see Appendix 4) and hydrochloric acid.

Category	Subcategory	Adhesive	Adhesive Species	Adhesive Origin
Animal	Albumin	Cow Blood Glue	*Bos taurus*	Western Asia
	Albumin	Egg White Glue	*Gallus gallus domesticus*	Southeastern Asia
	Casein	Milk Casein Glue	*Bos taurus*	Western Asia
	Collagen	Deer Bone Glue	*Cervus elaphus*	Europe, Anatolia, Iran, Central Asia, Northern Africa
	Collagen	Deer Hide Glue	*Cervus elaphus*	Europe, Anatolia, Iran, Central Asia, Northern Africa
	Collagen	Trout Bone Glue	*Salmo trutta*	Europe, Northern Africa
	Collagen	Trout Skin Glue	*Salmo trutta*	Europe, Northern Africa
	Collagen	Trout Swim Bladder Glue	*Salmo trutta*	Europe, Northern Africa
	Waxes	Beeswax	*Apis mellifera*	Global

Vegetable	Carbohydrates	Wheat Starch Glue	*Triticum aestivum*	Iran, Caucasus
	Latexes	Asafoetida	*Ferula foetida*	Iran
		Nettle Latex	*Urtica diocia*	Eurasia, Northern Africa
	Mucilages	Aloe Vera	*Aloe vera*	Southern Arabia
		Marshmallow Sap	*Althaea officinalis*	Western/Eastern/ Southern Europe, Western/Southern Asia, Northern Africa
	Resins/Gums	Acacia Gum	*Vachellia seyal*	Western/Northern/Central/Eastern Africa, Western Asia
		Cherry Gum	*Prunus avium*	Europe, Western Asia, Iran, Afghanistan, Northern Africa
		Chios Mastic	*Pistacia lentiscus*	Western/Southern Europe, Northern Africa, Western Asia
		Frankincense	*Boswellia sacra*	Western/Central/Eastern Africa, Southern Arabia, Southern Asia

	Gum Tragacanth	*Astragalus gummifer*	Western Asia, Iran
	Labdanum	*Cistus creticus*	Southern Europe, Anatolia, Levant
	Myrrh	*Commiphora myrrha*	Northern/Eastern Africa, Southern Arabia
	Pine Resin	*Pinus sylvestris*	Western/Northern/Eastern Europe, Balkans, Anatolia, Siberia
	Sandarac	*Tetraclinis articulata*	Northern Africa, Iberia
	Spruce Resin	*Picea abies*	Western/Northern/Eastern Europe, Balkans
Tars/Pitches	Birch Bark Tar	*Betula pubescens*	Western/Northern/Eastern Europe, Iberia, Anatolia, Iran, Siberia
	Pine Bark Tar	*Pinus sylvestris*	Western/Northern/Eastern Europe, Balkans, Anatolia, Siberia

Mineral	Bitumen	Bitumen	Bitumen	Global
	Plasters/Mortars	Lime Plaster	Calcium Oxide	Global
	Resins (Fossilised)	Amber	Baltic Amber	Western/ Northern/Eastern Europe

Table 3. Details of adhesives assessed experimentally.

3.3: Glue Production

While most adhesives could be purchased in a pure form requiring no alteration, some like birch bark tar were commercially unavailable and others (glues of a biological nature, lime plaster) were heavily altered with additional ingredients and preservatives. In addition, processing was required for the creation of compound adhesives utilising charcoal aggregate – lumps of charcoal were crushed to produce a fine powder that was mixed with an equal amount of melted beeswax to produce a solid aggregate/plasticiser mixture that could be used to produce compound adhesives without further processing.

Birch bark tar was produced via pyrolysis of four rolls of birch bark, constituting around 0.72m² in total, acquired from a commercial source. A two-chambered apparatus was set up to produce the purest possible tar without contamination from carbonised bark remains, consisting of a steel can positioned below a larger steel container in which the bark was packed (Figure 10). While use of ceramic vessels or other production methods might have enabled a more actualistic approach to tar production, this was not a goal of the experiments and metal containers were utilised out of convenience. A hole was punched in the base rim of the upper container, which was set at an angle using a flat rock to ensure birch tar fully drained into the can below (Figure 10). Three layers of aluminium foil were loosely wrapped around the steel can to prevent leakage or accidental contamination of tar by sand or charcoal – with holes in the upper container's lid also covered by foil to prevent ignition of the bark within.

Once filled with bark, this whole apparatus was buried in sand to about one-quarter of the height of the upper container to secure it in place (Figure 10). A fire was constructed around it using wooden logs and branches, which was maintained at temperatures generally in excess of 400°C for 6-9 hours (Table 4 and Figure 10). Due to repeated issues with incomplete bark pyrolysis, possibly from length of time heated or how tightly the container was packed, this process had to be done in three separate batches. A fourth batch had to be produced after some tar (~130ml) was spilled in the process of reduction. Upon batch completion, the upper container and flat rock were carefully lifted away from the can, which was removed from its protective foil. Around one-third of a can's worth of tar (~150ml) was produced in each batch, which was then consolidated into a single can practically full of tar (~480ml).

Batch Number	Amount of Bark	Time Heated	Temperature Range	Tar Produced
#1	$0.18m^2$	8 hours	400-850°C	160ml
#2	$0.18m^2$	7 hours	250-650°C	150ml
#3	$0.18m^2$	9 hours	350-750°C	180ml
#4	$0.18m^2$	6 hours	250-800°C	120ml

Table 4. Details of tar production from birch bark.

Figure 10. Birch tar production: (A) upper container packed with bark, (B) appearance of apparatus as buried sans protective foil, (C) buried apparatus, (D) fire as lit around the apparatus, (E) apparatus after fire extinguished, (F) pyrolysed bark remains in upper container, (G) reduction of birch tar into pitch.

Birch tar was reduced down by a third (to ~350ml) by simmering over red hot coals for an hour, to produce a thicker pitch more suitable for adhesive use (Figure 10). However, a second phase of reduction had to be undertaken due to issues with application of birch tar to experimental foci – it refused to dry (see Chapter 5). This lasted 1 1/2 hours and reduced the original amount by nearly two-thirds (to ~175ml) until it became fully solid upon cooling. The same process was repeated with commercially acquired pine tar, which was reduced in volume by half from 400ml to 200ml. Reduction was performed over red-hot coals as opposed to an open flame, to avoid tar ignition.

A variety of collagen glues were prepared from two species – red deer and trout – listed below in greater detail (Table 5). Multiple species were examined to assess differences between terrestrial and aquatic sources – with red deer selected as it occurs cheaply in the form of rolled hide dog chews. A deer bone was also purchased. Initial attempts were made to produce fish glues from waste cod skin and halibut bone acquired from a local fishmonger, but only small amounts of viable adhesive were produced. Trout was selected for more widespread fish glue production as they could be purchased whole and ungutted in a pack, allowing all fish glues to be processed simultaneously. Swim bladders were excised and the trout skinned and boned. These materials were cut into small 2-3cm chunks to allow collagen to be leeched more easily, with the exception of deer bone which was wrapped in a thick kitchen towel and shattered into suitable pieces with a mallet, with its marrow then removed.

Glue materials were each simmered for ~8 hours in a saucepan containing twice as much water by mass (Table 5 and Figure 11). While it was aimed to keep temperatures between 60-90°C to avoid negatively impacting glue quality through overheating, it frequently varied higher due to the duration of heating and issues with controlling heat produced by an open flame (Schellmann, 2007; Hull and Bangert, 1952). Water levels were maintained until the last hour of heating when they were permitted to gradually reduce to thicken the adhesive. The resulting liquid was drained through a thin-mesh sieve into a separate bowl and left for 12 hours until the collagen-rich mixture had fully gelatinised, to ensure its adhesive nature. Fish glues had a substantial layer of oil at their surface, which had to be absorbed using paper towels. These perishable glues were then sliced up and dehydrated to avoid the effects of bacterial/fungal action before experiments commenced. Cut pieces were placed into a kitchen dehydrator set at 60°C in aluminium foil boats causing them to reliquefy and slowly reduce into dried glue over the course of 48 hours, which could be stored as crystalline flakes (Figure 11) near indefinitely without compromising adhesive effectiveness (Weisshaar and Shipman, 1988; Sweatt, 1946).

Glue Type	Amount of Material	Amount of Water	Time Heated	Temperature Range	Glue Appearance
Deer Hide Glue	150g	300ml	8 hours	81°C-115°C	Pale Brown
Deer Bone Glue	300g	600ml	8 hours	78°C-93°C	Pale White-Brown
Trout Skin Glue	200g	400ml	8 hours	86°C-104°C	Pale Brown
Trout Swim Bladder Glue (Failed)	50g	100ml	8 hours	79°C-102°C	Medium Yellow-Brown
Trout Bone Glue	150g	300ml	8 hours	84°C-111°C	Medium Brown

Table 5. Details of collagen glue production from animal materials.

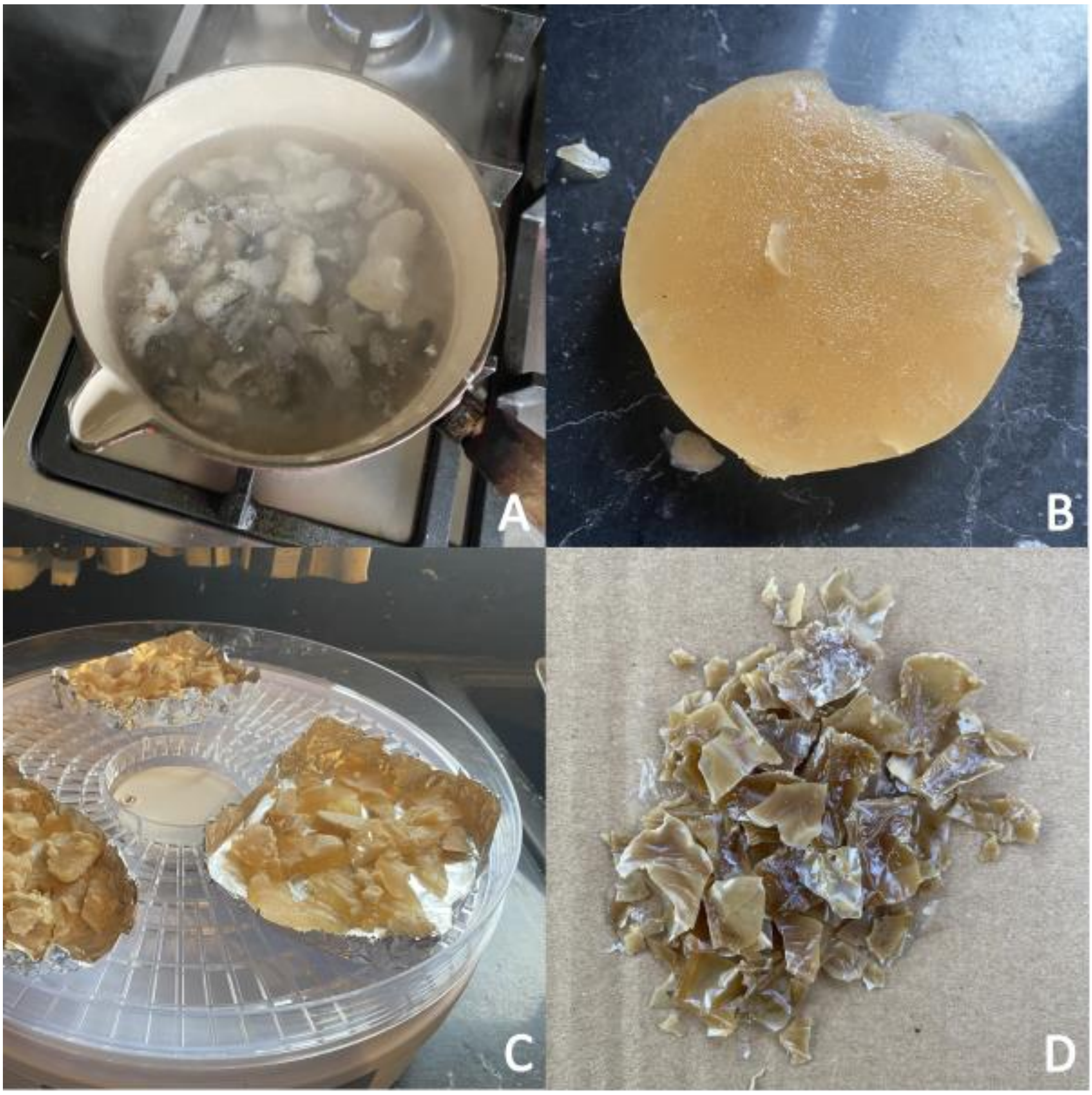


Figure 11. Collagen glue production: (A) simmering of trout skin to leech collagen, (B) gelatinised deer hide glue, (C) dehydration of various collagen glues, (D) dried flakes of deer hide glue.

Due to issues with leeching collagen from deer bone on a first attempt, hydrochloric acid was applied to speed up the process by removing its mineralised element. Bone fragments were placed in a glass bowl, submerged in acid and left in an isolated location for 48 hours until the bone took on a rubbery texture. The acid was then neutralised and disposed of. An attempt was made to produce glue from swim bladders, which are held to produce the strongest fish-based adhesives, but the five small trout bladders processed made only an oily non-adhesive mixture (Hems and Curtis, 2015; Petukhova, 2000).

In addition to collagen glues, blood glue was assessed using powdered cow's blood, as fresh animal blood was impossible to procure in suitably small quantities. 50g of powdered blood was mixed with 180ml of water and 5 pinches of wood ash to produce a thick red-black mixture. Alkalis such as wood ash improve the properties of albumin and casein glue mixtures considerably and are universally added to such adhesives today – and were therefore included in this experiment's assessment of blood, egg and casein glues (Guo and Wang, 2016; Lambuth, 2007; Anderson, 1990). This ash derived from fires used for birch tar production and had to be sieved to remove small stones, but was otherwise relatively pure, containing little in the way of charcoal or other contaminants. Egg white and milk casein glues were produced from easily available products due to their commonality. Casein glue was produced from 475ml of whole milk gently heated to 44°C in a saucepan with 100ml of pure spirit vinegar added to induce separation of whey, which was then drained off. The remaining curds were mixed with 190ml of water and 5 pinches of wood ash to produce a moderately thick paste, light grey in colour with darker spots from the wood ash. This non-adhesive mixture was heated in a saucepan for 2 minutes to produce adhesive casein glue. Egg white glue was produced from the white of four eggs separated into a bowl and whipped to produce a foam, to which 5 pinches of wood ash were added to produce a mixture similar in colour to casein glue.

Lime plaster was produced from 250g of commercially sourced calcium oxide mixed with an equal quantity of water. Finally, marshmallow sap (mucilage) could not be obtained in any form that was not a tincture – so an attempt was made to drive off added alcohol by heating in a saucepan for 15 minutes until it reduced 90% in volume to produce a faintly adhesive liquid.

3.4: Strength Experiments

Tool production for strength testing was undertaken at the YEAR Centre, an outdoor workspace for experimental archaeology located on the University of York campus, over the course of three weeks. Blades made from Norfolk flint ranging from 6-10cm in length and 3-5cm in width (see Appendix 5) were produced in two ways – some by an experienced flintknapper at the university and others, due to access issues, in the form of blade preforms from a commercial source. These preforms were retouched to an appropriate size by the author if too large and sharpened to enable their use in sawing. Blades were fitted in hafts produced from green hazel wood branches around 1.5cm in diameter cut to a length of roughly 15cm and split about halfway down. It may have been easier to assess rate of adhesive failure by cutting a notch rather than having pressure applied by a split haft, but initial tests indicated this required highly specific and time-consuming adjustments for each flint tool. However, tools were set vertically in their hafts by their proximal ends, rather than laterally, to promote quicker failure of adhesive bonds without the reinforcement of laterally placed wood to absorb the force of sawing motions.

A fire was constructed using split birch logs and maintained at temperatures in excess of 300°C to produce a bed of hot coals, on which adhesives were melted in saucepans (Figure 12). Resin/gum adhesives were first crushed into powder using a mortar-and-pestle and dehydrated animal glues plus drier gums/latexes (acacia gum, asafoetida, cherry gum, nettle latex) were rehydrated for use. Adhesive quantities varied, but were measured out using glass beakers and an electronic weighing scale to determine the correct proportions of aggregate/plasticiser to incorporate into the mixture. Adhesives were only heated for the minimum time required to enable their application to tools (as well as cubes for waterproof testing) to avoid reducing them by differential degrees. Some glues were ineffective and so were not utilised in hafting (aloe vera, amber, marshmallow sap). Mucilages possessed very limited adhesiveness and – no matter what conditions it was subject to – amber failed to produce any adhesive substance. Plain adhesives were hafted first, then beeswax/charcoal were added to the remaining mixture to produce compound tools. Glue was applied to each tool before it was placed in its haft, whereupon further adhesive was set over the top, sides and base of the tool-haft junction in a layer ~1cm thick (Figure 12) before 140cm of artificial sinew binding was wrapped around the hafted area. Artificial sinew made from waxed polyester was utilised to avoid the expense of procuring necessary quantities of actual sinew for the tools being produced, as well as the difficulty of preparing them for use. Immediately after production, tools were propped up on two sticks to allow the adhesive to dry out of contact with the ground. Some adhesives dripped heavily and had to be rotated to prevent accumulation of material at one side of a tool. Weather conditions, temperature and humidity were recorded during the hafting process to determine if environmental factors during production might have impacted adhesive performance (see Appendix 6). A wooden shelter covering the firepit area protected against direct rain exposure.

Finished tools were left to dry for a minimum of two weeks before testing in a shed within the YEAR Centre, where they were exposed to a dry but ventilated environment. They were then tested in an indoor environment by sawing at a rapid pace (around 45 strokes per minute) on birch logs (Figure 12). Adhesive failure was deemed to have occurred when a tool became loose in its haft to a degree greater than 1cm when manipulated. Photographs were taken of tools before and after testing (once disassembled) to compare changes and assess adhesive preservation (see Appendix 8). The status of each adhesive was noted to assess its relative strength when utilised in a high-stress task and further details were noted of how the adhesive performed during use – whether a smell was produced or any material detached. If tools became blunt, they were carefully resharpened to enable their continued testing.

Figure 12. Strength experiments: (A) melting of Chios mastic in a saucepan, (B) flint tool fixed into a wooden haft with the same adhesive, (C) testing of same tool by sawing birch wood logs.

3.5: Resistance Experiments

Water resistance experiments were conducted using a large transparent plastic tub filled with roughly 24 litres of water to a depth of 14cm, although this amount reduced slightly over the course of each batch to around 12-13cm of water due to the repeated removal of waterlogged material. Two small pine wood cubes each measuring $3cm^3$ were glued together (Figure 13) using the particular adhesive being tested and submerged in two separate batches, due to the number of adhesives being examined. These constituted 50 in total, 24 in the first batch and 26 in the second. In all cases, some adhesive was allowed to seep out to form a 1-2cm layer around the sides of the bond sealing the cubes together – which ensured both failure of adhesive bonds exposed to water and the direct exposure of adhesive material to water could be simultaneously assessed. If the adhesive bond of a set of cubes failed, their testing continued to allow continued examination of direct adhesive exposure. To assist in identification, glued cubes were marked with a waterproof marker on both ends.

Cubes were left submerged for a total cumulative period of 24 hours, but were removed at regular intervals to evaluate the length of time each adhesive could withstand direct water exposure. These were set at 5 minutes, 15 minutes, 30 minutes, 1 hour, 1 hour 30 minutes, 3 hours, 6 hours, 12 hours and 24 hours. Water was not replaced between intervals to ensure conditions remained constant, which had no effect other than a slight yellowish-brown discolouration from leeched adhesives, but was changed between different batches. The plastic tub itself was stored in a cool, dry area. Most cubes ended up floating on the surface of the water, being more buoyant than anticipated, requiring use of a metal tray and a brick to ensure they remained submerged and evenly exposed to the water (Figure 13). The tray was gently lowered into place to avoid damaging the adhesive bonds or causing air pockets to form between the tray and water, with all cubes in a batch positioned beneath it. Once removed for examination at each interval, cubes were left to dry for roughly 20-30 minutes to ensure they could be more easily handled and photographed, although initial impressions of appearance and bond strength were noted immediately on removal. Visual assessment was made of the condition of adhesive present on the exterior of the cubes, assessing discolouration, water absorption, friability and areas of loss. Photographs were taken of all four cube sides (see Appendix 9) to allow for assessment of adhesive condition, as well as the bond surfaces if the adhesive bond had already failed.

Figure 13. Water resistance experiments: (A, B) cubes glued with compound acacia gum adhesive before and after submersion for 48 hours and (C) experimental setup.

3.6: Summary

Research methodology was approached by two main avenues – databases and experimental work. A database was constructed in Microsoft Excel to consolidate archaeological adhesive data for easier analysis. Experimental work focused on a range of different adhesive types from the regions under focus and consisted of comparative strength testing of adhesives via testing of hafted tools, as well as submersion of adhesives in water for a set period to examine water resistance. A number of these adhesives had to be produced manually due to commercial unavailability or unsuitability – such as birch tar and collagen glues.

4: Database Results

Continuity and difference in adhesive usage and production between the Late Epipalaeolithic/Mesolithic and Neolithic periods is evaluated in the following two chapters. The first, presented below, evaluates a database of archaeological adhesive evidence, assessing a range of different factors – adhesive class, use and additive use. This encompasses broad temporal and regional differences, site distribution and analytical techniques employed to identify adhesives. Charts and maps are employed to present this evidence in a more interpretable format.

4.1: Overview of Site Data

Adhesive evidence derives from a total of 433 individual sites – 308 in Europe and 125 in the Near East. The majority (365) are wholly Neolithic, with only 66 originating from the Late Epipalaeolithic/Mesolithic and continuity across both periods evident at just 2 European sites.

Most adhesive evidence by site count in European in origin, especially for the Late Epipalaeolithic/Mesolithic – concentrated in Central Europe, the Balkans and Greece (Figure 14). Outside of these regions, sites are more widely distributed. Considerable difference is evident between Mesolithic and Neolithic site distribution – Mesolithic sites concentrate heavily in Northern Europe (particularly Scandinavia and the Baltic) whilst Neolithic sites cluster in Central/Southern Europe. Near Eastern Neolithic sites exhibit strong concentration within the Fertile Crescent/Levant region – with only sporadic evidence from Southern Turkey, Azerbaijan, Eastern Iran and the Gulf region (Figure 14). No evidence for adhesives is attested from Northern Turkey or most of the Arabian Peninsula, except for a handful of sites along its Gulf coast. Late Epipalaeolithic sites are limited entirely to the Southern Levant, except for Shanidar in Northern Iraq.

Chemical analysis was utilised to examine adhesives at a significant minority of sites, comprising the largest percentage amongst the analytical techniques employed (Figure 15). Its use varied by region – being employed on most

European sites but only a third of those within the Near East – with this disparity particularly noticeable for Neolithic sites. However, less temporal differentiation is present when considering both regions combined. While fewer sites employed visual approaches to examine adhesives, many discussed their use without reference to any analytical techniques employed – comprising a majority of all Near Eastern sites (Figure 15).

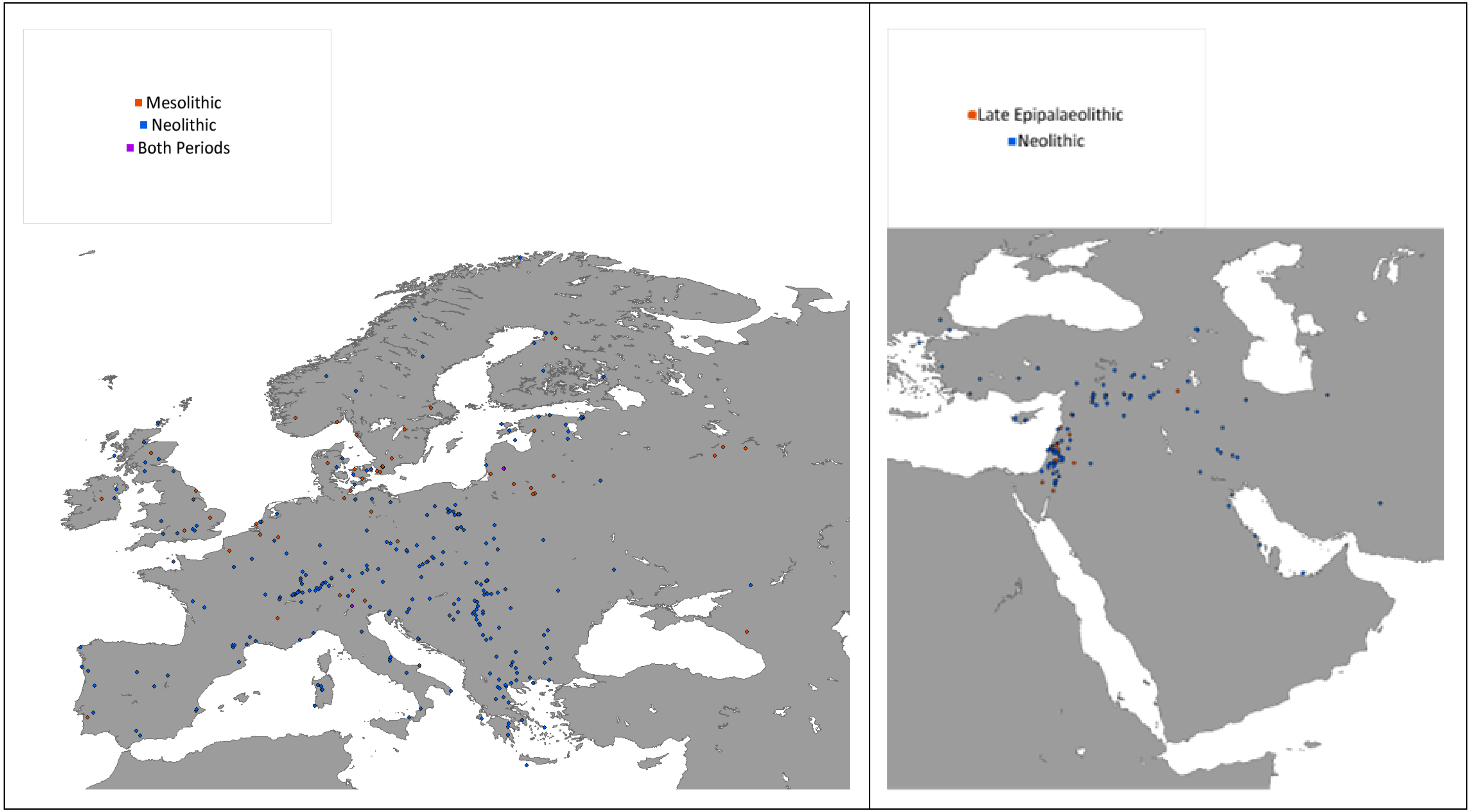


Figure 14. Distribution of adhesives on European and Near Eastern sites, by period.

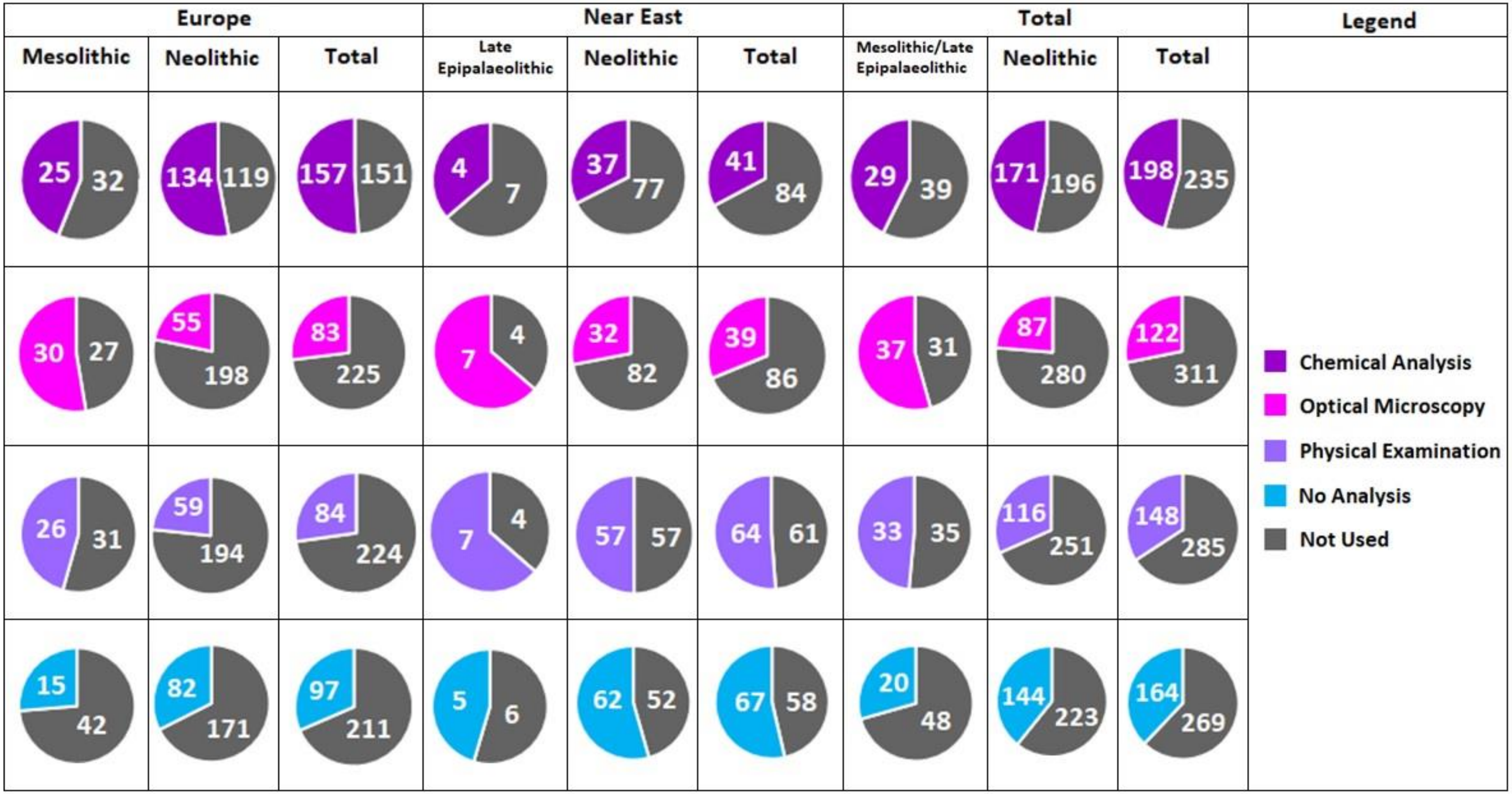


Figure 15. Sites providing evidence of adhesives, divided by region, period and methodology employed.

4.2: Overview of Adhesive Classes

528 general adhesive class identifications and 606 specific adhesive class identifications were made across the 433 archaeological sites identified. Plasters constitute the largest general class, with tars second highest (Figures 16 and 17). Meanwhile, animal glues form the smallest attested class at just 1.9%.

Whilst comprising the majority of Near Eastern adhesives, plasters form just 26% of the European total. In Europe, this is almost entirely Neolithic in origin, with just 5.4% deriving from the Mesolithic. Bitumen shows a similar distribution with significantly greater presence in the Near East compared to Europe. Although a wider variety of adhesives are attested in the Near Eastern Neolithic, with small quantities of animal glues and beeswax attested for the first time, the overall proportion of non-plaster/bitumen adhesives declines relative to the Late Epipalaeolithic (25.1% to 11.7%). European sites display far greater heterogeneity – tars comprise 26.8%, with sizeable percentages (9-12%) each formed by plasters, resins and unidentified adhesives. Beeswax and plasters are more significant in the Neolithic data whilst resins and unidentified adhesives comprise far greater proportions of Mesolithic evidence. However, the overall number of resins and unidentified adhesives remains broadly similar across both periods.

The majority of plasters derive from the Neolithic (93.6%) with roughly equal proportions attested in each region (Figures 16 and 17). However, Near Eastern Neolithic plasters originate from a greater number of the sites considered (75.4% Near East vs. 36% Europe). Similar regional differences by site are exhibited by Late Epipalaeolithic/Mesolithic plasters (72.7% Near East vs. 7% Europe). Considerable variety is evident in the types of plasters attested (Figure 18) – whilst the largest component remains unidentified, clay and lime plasters form the largest identified segments. Gypsum and mud comprise smaller but still significant components with other types (chalk, dung, loam and marl) constituting only a handful of examples. Whilst most Late Epipalaeolithic plasters are lime (with mud and unidentified plasters forming equal proportions of the remainder), European Mesolithic evidence consists entirely of clay plasters. Neolithic plasters exhibit less homogeneity – with Near Eastern evidence particularly diverse. Clay, gypsum, lime, mud and unidentified plasters each form between 13.5% and 25% of the total, with less variety present in Europe, where clay and unidentified plasters together form 89.8% of the total.

Tars comprise the next highest percentage – deriving entirely from European sites, mostly in the Neolithic (Figures 16 and 17). Birch bark tar massively predominates tars overall (78.8% total) and remains remarkably consistent across the Mesolithic and Neolithic (Figure 19). Specific alternatives to birch bark tar derive solely from the Neolithic.

Beeswax, bitumen, resins and unidentified adhesives form similar proportions of adhesives overall, but differ considerably by region and period (Figures 16 and 17). Beeswax largely originates from the European Neolithic (84%), with only a small percentage of Near Eastern sites (2.4% compared with 15.3% of European ones) attesting beeswax. Bitumen, meanwhile, demonstrates an opposing pattern with 65.2% deriving from the Near East – constituting a significantly higher percentage of total sites (37.6% Near East vs. 6.2% Europe).

Resins show a similar use proportionality to beeswax, with 92.5% deriving from European sites, although they constitute a similar percentage of sites in both regions. The majority of resin evidence derives from the Neolithic despite constituting a larger proportion of Late Epipalaeolithic/Mesolithic evidence overall. While a wide range of different resins are attested, the majority are identified as either pine resin (42.9%), unidentified resins (30.4%) or general conifer resins (12.5%) with other varieties constituting only isolated examples (Figure 20). European evidence is more diverse, with 8 varieties attested compared to just 3 from the Near East. Near Eastern resins are represented by 2 unique types not found in Europe (Neolithic) or are entirely unidentified (Late Epipalaeolithic). Pine constitutes the majority of specific European Neolithic evidence (60.5%) but is almost absent from the

Mesolithic (7.1%) where generic identifications of conifer or unidentified resins are more frequent.

Most unidentified adhesives derive from European sites, comprising a significant proportion of European Mesolithic sites (45.6%) compared with European Neolithic (9.1%) and Near Eastern (10.4%) sites (Figures 16 and 17).

Animal glues form the least frequent general adhesive class – with 80% deriving from the European Neolithic period (Figures 16 and 17). Egg glues constitute 60% of the total, with collagen and unidentified animal sources forming another 20% each (Figure 21). The sole Near Eastern example is a collagen glue, while the European Mesolithic example remains unidentified.

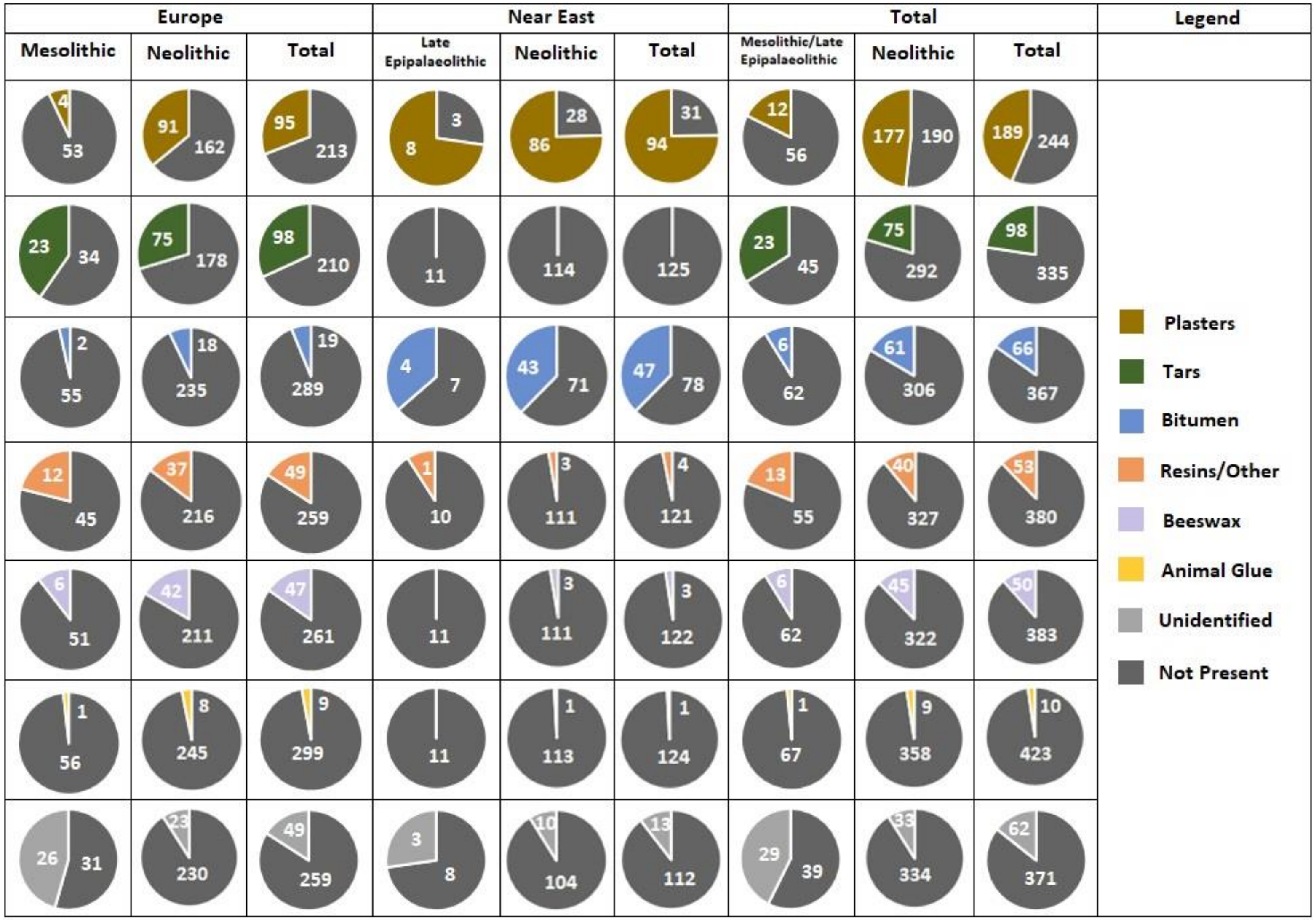


Figure 16. General adhesive class by number of sites, divided by region and period.

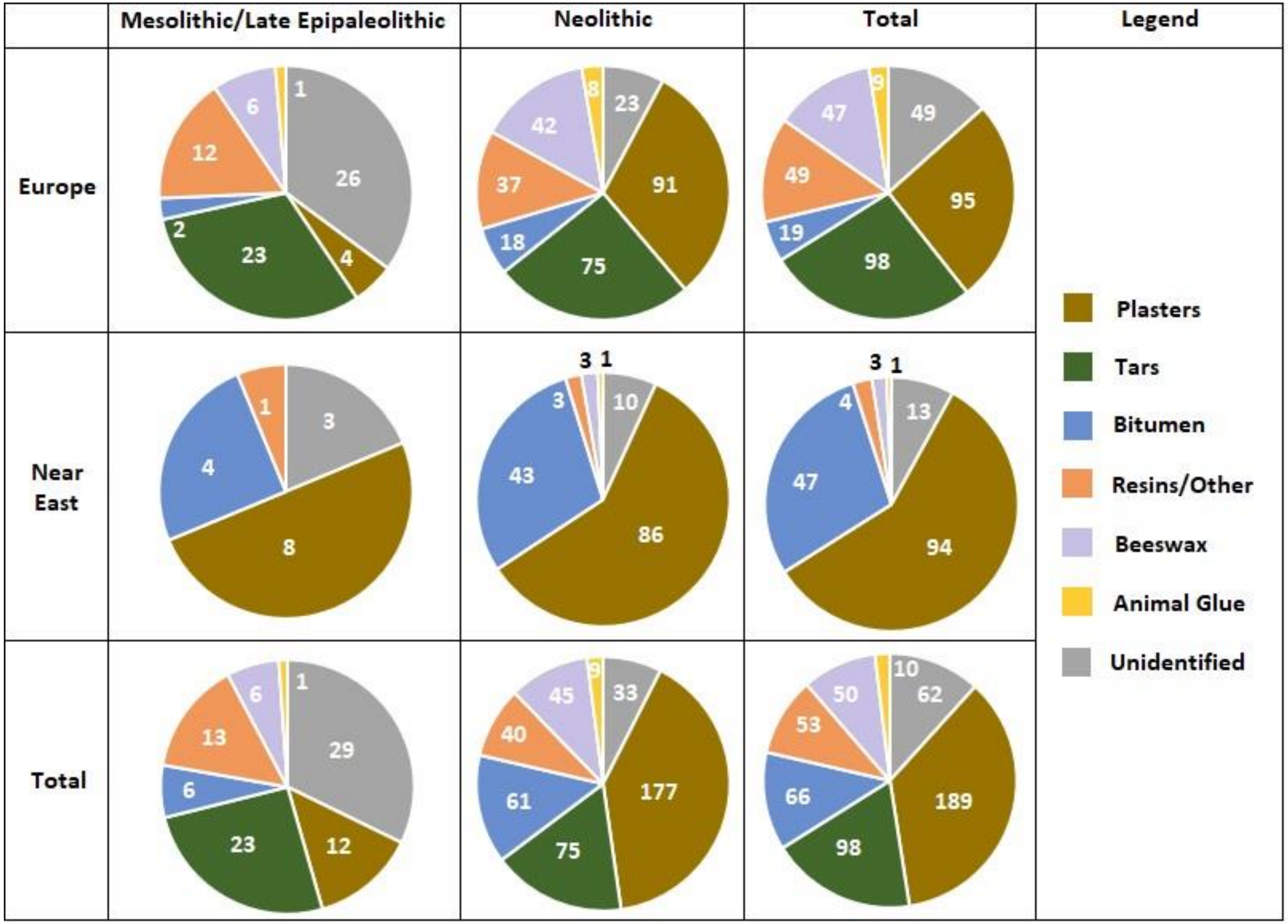


Figure 17. General adhesive class, divided by region and period.

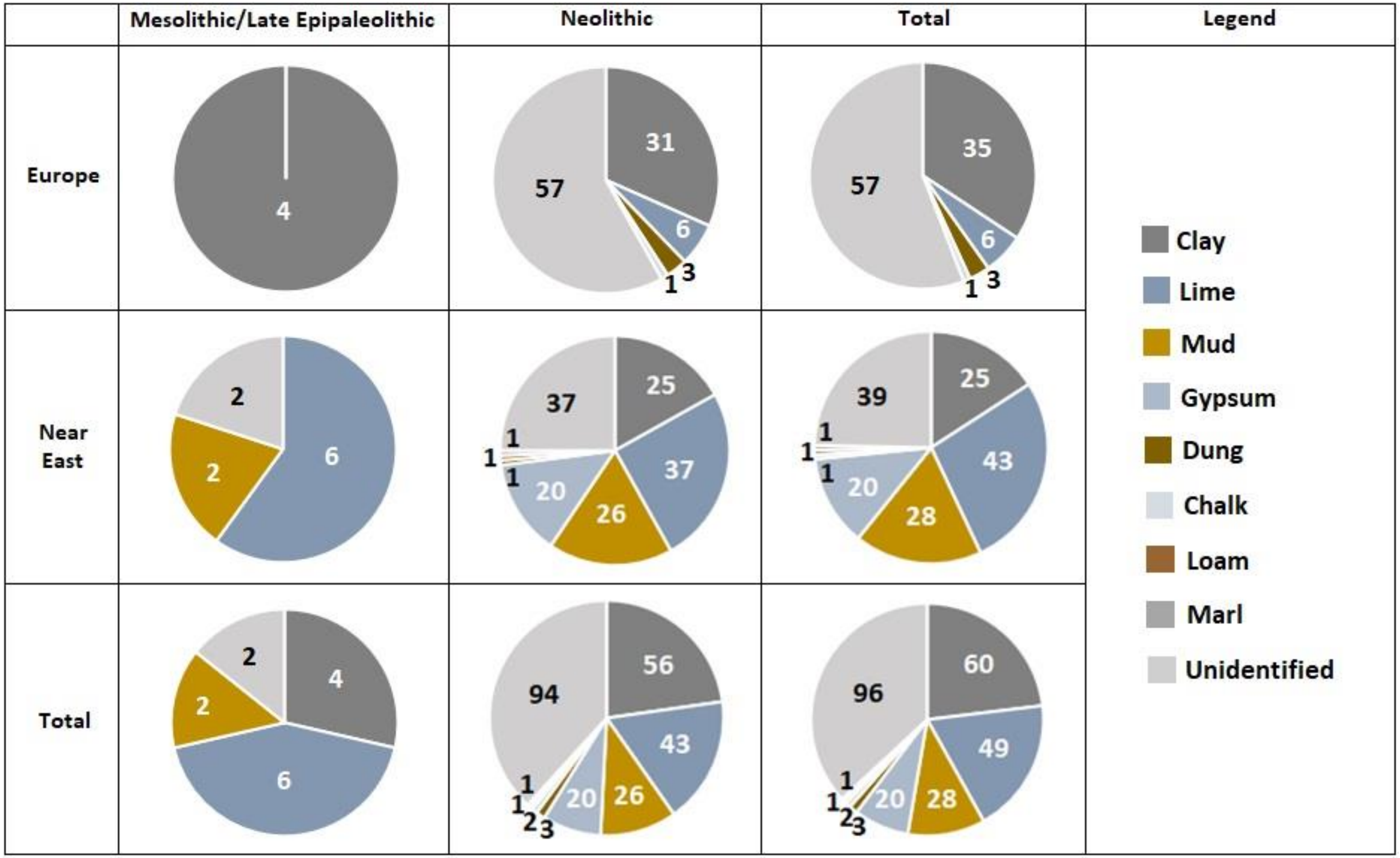


Figure 18. Attested plasters by specific class, divided by region and period.

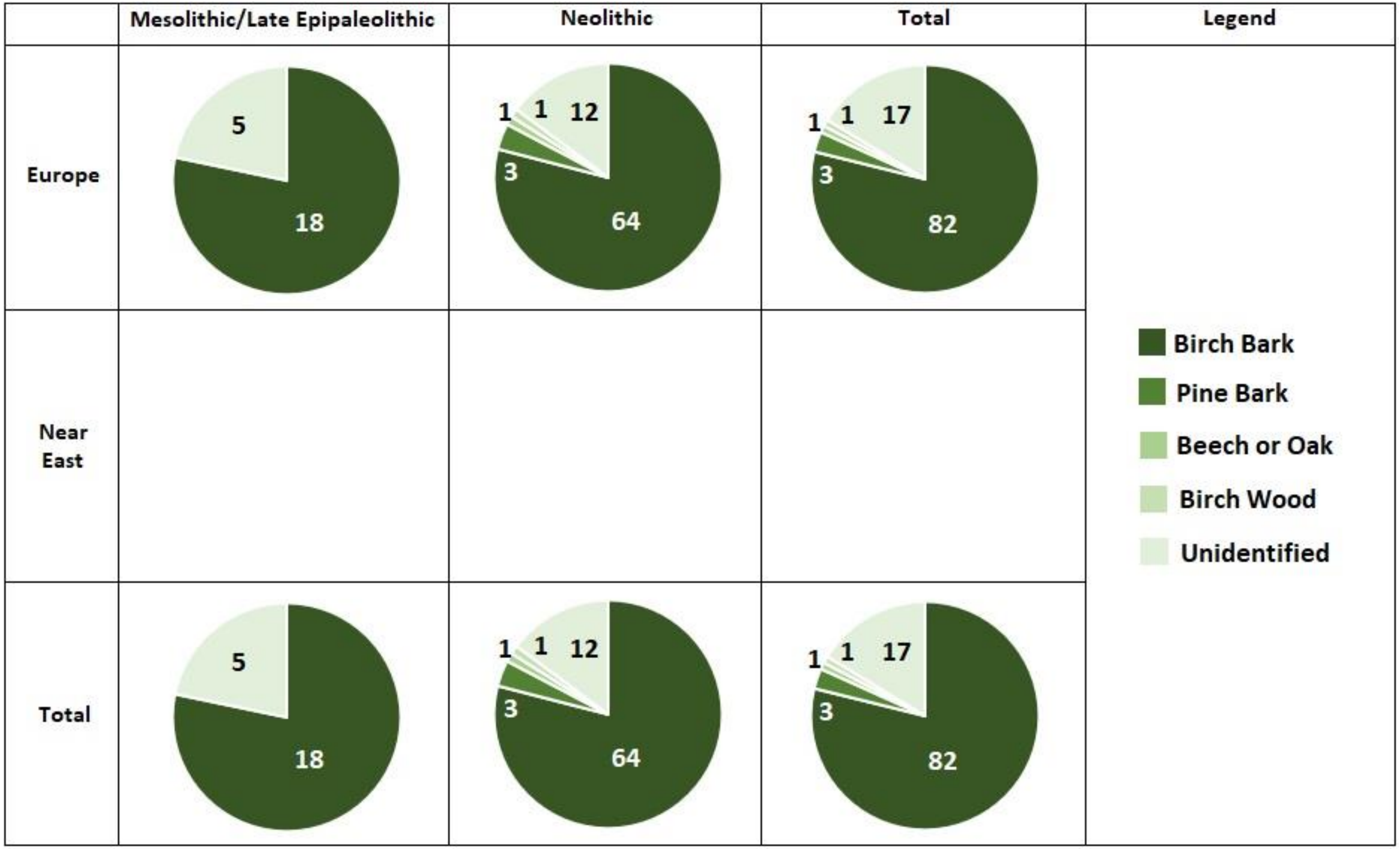


Figure 19. Attested tars by specific class, divided by region and period.

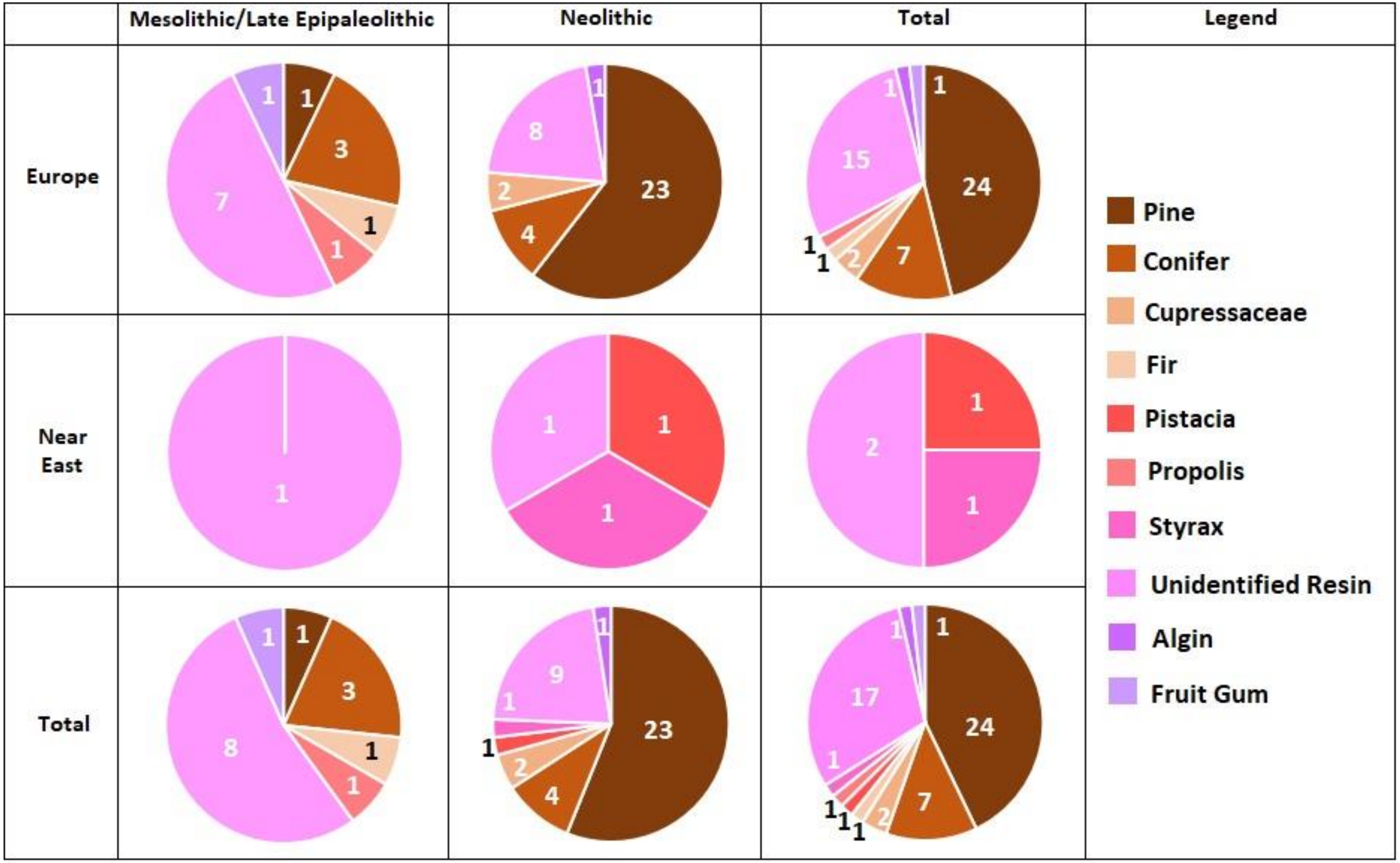


Figure 20. Attested resins/other by specific class, divided by region and period.

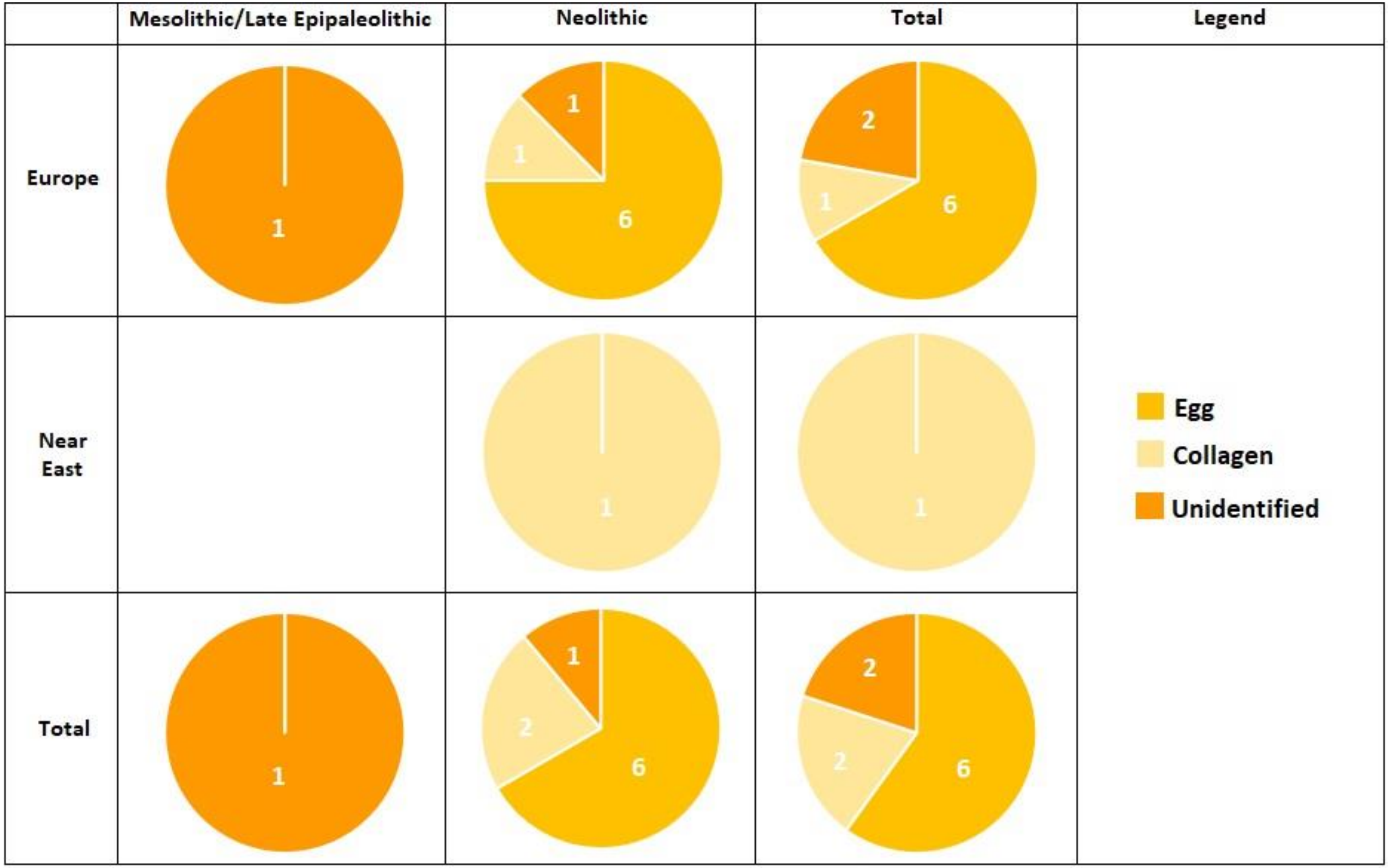


Figure 21. Attested animal glues by specific class, divided by region and period.

4.3: Distribution of Adhesive Classes

Plasters are widely distributed across Europe – apart from Scandinavia, France, Italy and Russia which attest only a handful of examples if any (Figure 22). There are particularly strong concentrations in Eastern Europe (Czechia and Poland), the Balkans and Greece. Clay and unidentified plasters concentrate here with a handful of examples from Scandinavia, the UK, France and the Iberian Peninsula. Lime plaster is limited to Northern Germany/Poland and Southern Serbia/Northern Greece – whilst chalk and dung plasters occur on a handful of sites in the UK and Northern Greece respectively. Plaster is more widespread across the Near East – with significant regional patterning (Figure 22). Clay, lime and mud concentrate in the Southern Levant with isolated examples from Eastern Syria and Southern Turkey, whereas gypsum is mainly distributed in Eastern Syria/NW Iraq with a handful of examples elsewhere – e.g., Southern Levant (Figure 23). Unidentified plasters concentrate in the main research areas – the Levant and Fertile Crescent.

Tars derive solely from Europe, largely clustering north of the Alps as well as in Serbia/Greece, Poland, Eastern Denmark/Southern Sweden and Finland (Figure 24). However, they are wholly absent from the Iberian Peninsula, most of Italy, the Eastern Balkans and Russia. Mesolithic tars are almost entirely concentrated in Northern Europe apart from a cluster in Southern Germany/Northern Italy. In contrast, Neolithic tars cluster immediately north of the Alps, as well as Eastern Europe and Finland. The majority of tar is produced from birch bark, with a handful of pine tar examples attested from Northern Greece and Central Europe. Unidentified tars appear in Poland and the Baltic, with isolated beech/oak and birch wood tar examples attested from Eastern Germany/Western Poland.

European beeswax largely derives from Central Europe along the northern edge of the Alps (Eastern France and Southern Switzerland/Germany) as well as Slovenia and Northern Greece (Figure 25). It is wholly absent from mainland Scandinavia, the Iberian Peninsula, most of Italy and much of

Eastern Europe. It appears concentrated in Northern Europe in the Mesolithic (Eastern UK, Northern Germany, Lithuania and Northern/Central Russia) except for a single Italian site. Neolithic evidence originates from all areas discussed except Russia. Beeswax is only present on the western periphery of the Near East, with three examples attested from Turkey.

Bitumen is concentrated in Central Europe on the northern side of the Alps (Southern Switzerland/Germany) and the Eastern edge of the Italian Peninsula, with isolated examples from Germany and Hungary (Figure 26). Most is Neolithic, with just two Mesolithic sites (Northern Italy and Germany). Wider distribution is seen across the Near East – with examples from peripheral regions (Southern Turkey, Azerbaijan and the Gulf) presenting alongside major areas like the Levant and Fertile Crescent (Figure 26). Here, strong clusters exist in the Southern Levant, Eastern Syria/NW Iraq and Western Iran. Late Epipalaeolithic finds are more restricted, with two sites in the Southeastern Levant and one in Northern Iraq.

Resins are broadly distributed in Europe, with strong clustering in Estonia and the Iberian Peninsula and notable absence in much of France or Italy (Figure 27). Mesolithic evidence concentrates in Scandinavia while Neolithic resins appear more widely distributed. Pine is the majority resin in Estonia and the Iberian Peninsula, with isolated examples in the UK, Scandinavia, Central Europe, Balkans and Greece. Conifer and unidentified types are more widely scattered – the latter clustered in Finland and the UK. Two Cupressaceae examples are attested from Greece and Northern Sweden but other types comprise isolated examples in Portugal (algin), Estonia (fir resin), Southern Russia (fruit gum) and Northern Italy (propolis). Near Eastern resins are almost entirely isolated to the Southern Levant, with an isolated Pistacia resin in Northwestern Iran (Figure 27). The remainder are unidentified apart from one instance of styrax resin. Conifer resins are entirely absent.

Unidentified adhesives are scattered across Europe with concentrations in Lithuania, Southern Sweden and Switzerland (Figure 28). None are attested from Italy. In the Mesolithic examples are largely limited to Northern Europe, whereas these predominate in Central Europe in the Neolithic. Near Eastern examples concentrate in the Southern Levant (Figure 28), with two Neolithic examples in Eastern Syria/NW Iraq and another in Eastern Iran.

Animal glues concentrate in Southwestern Europe, especially Sardinia (egg-based) (Figure 29). Three further examples present elsewhere in Europe – in Switzerland (collagenaceous), Poland and Southern Russia (both unidentified). Collagen glue is also attested in a single example from the Southern Levant.

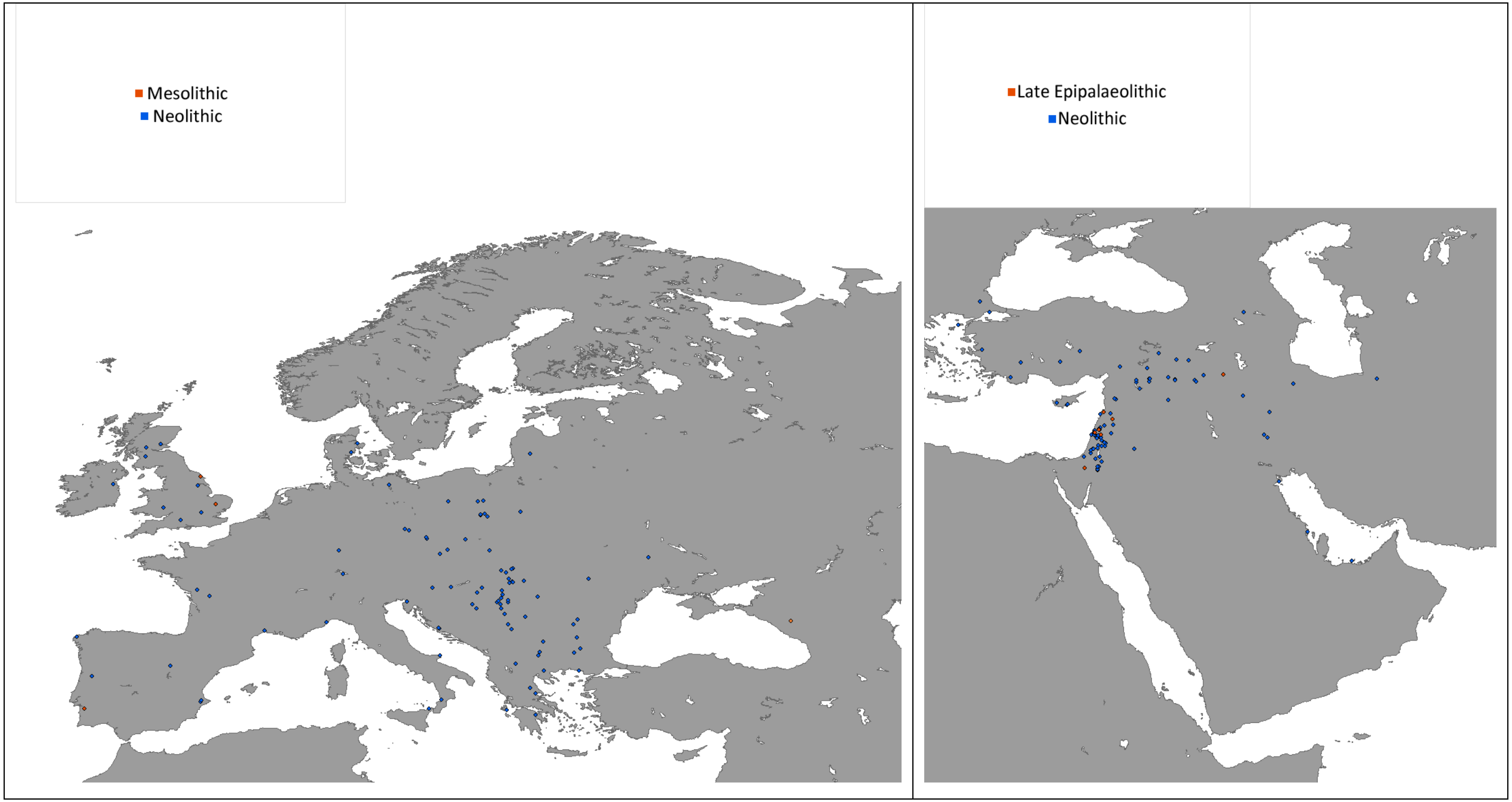


Figure 22. Distribution of plasters on European and Near Eastern sites.

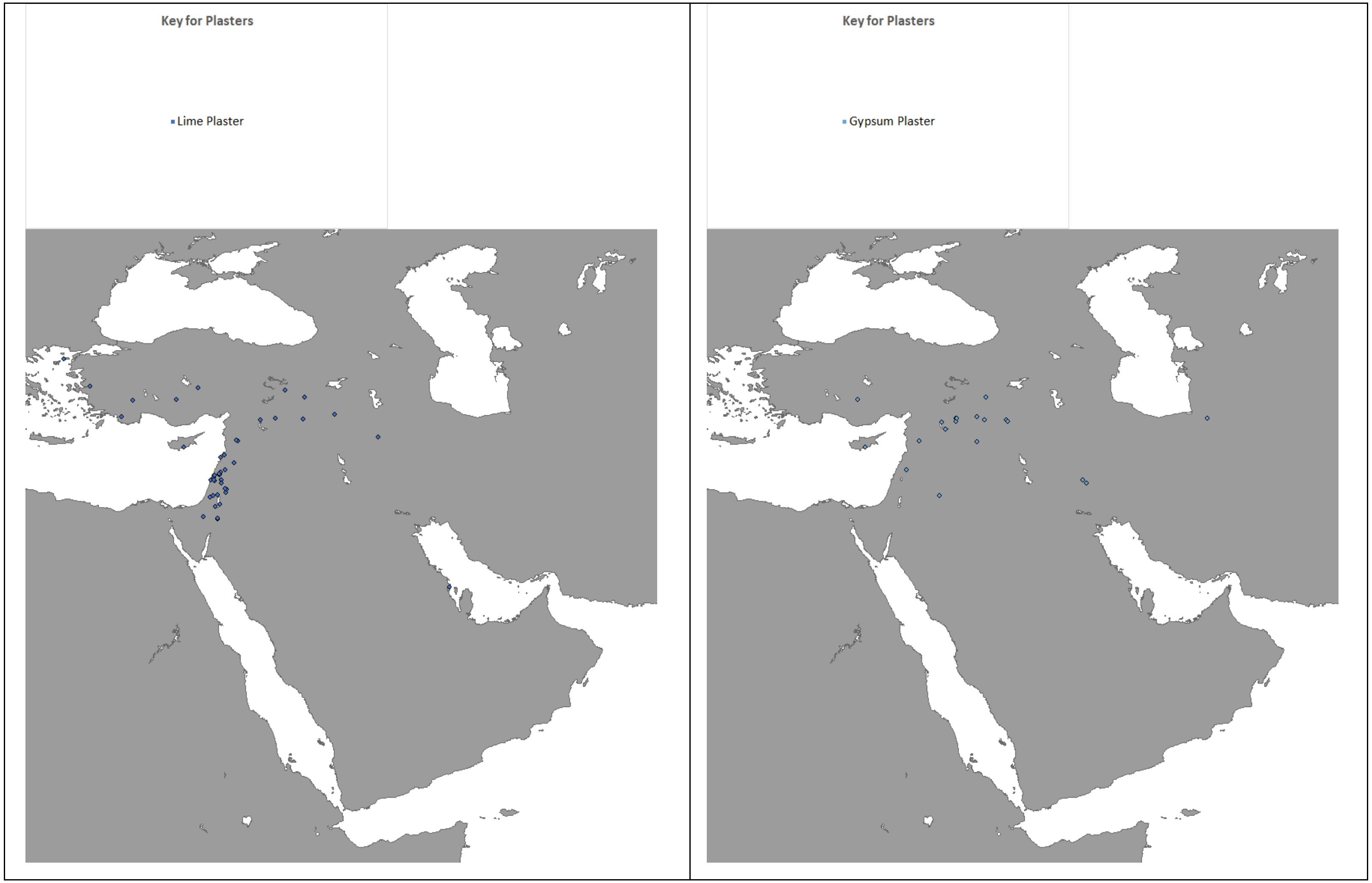


Figure 23. Distribution of lime and gypsum plasters on Near Eastern sites.

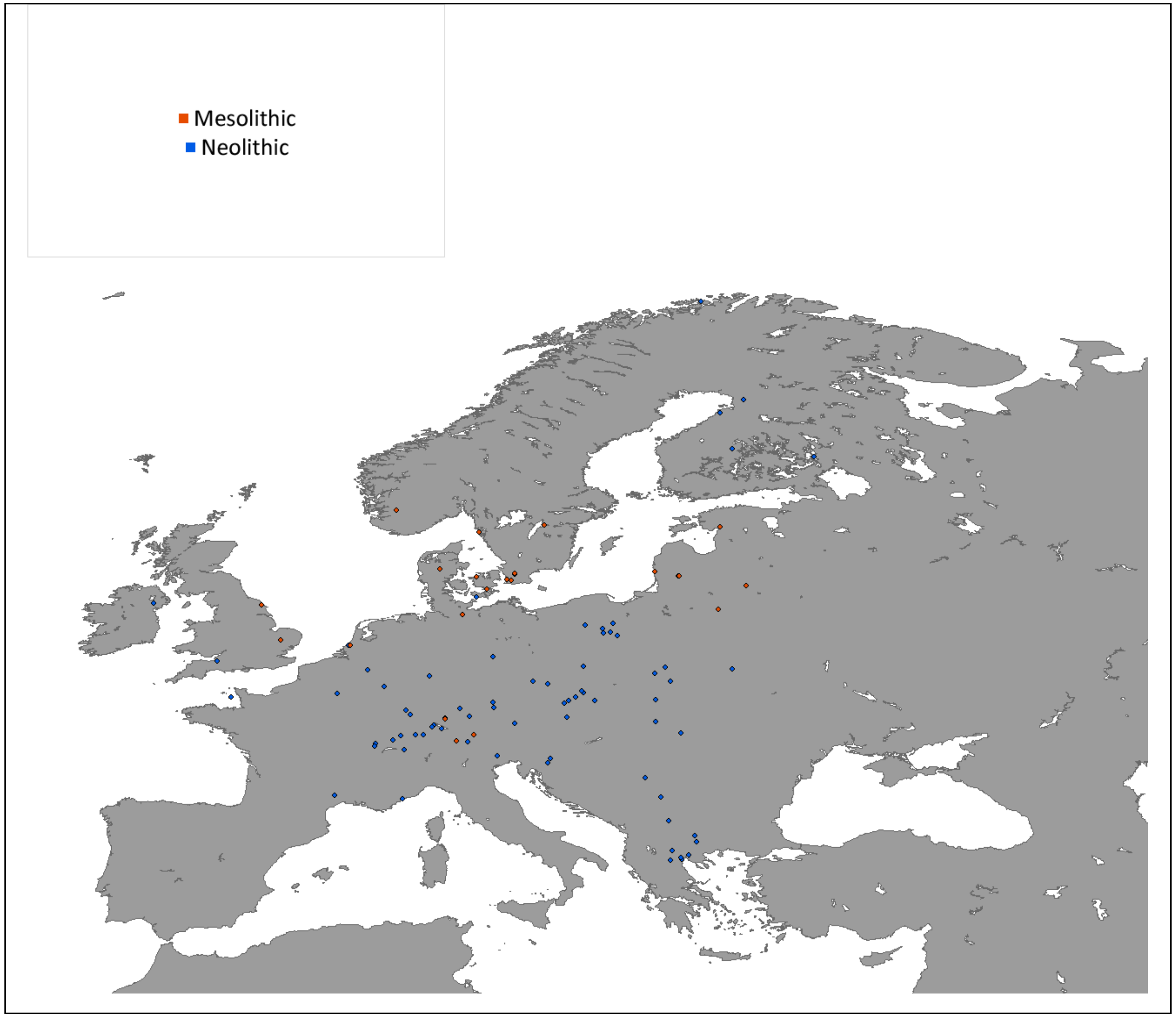


Figure 24. Distribution of tars on European sites.

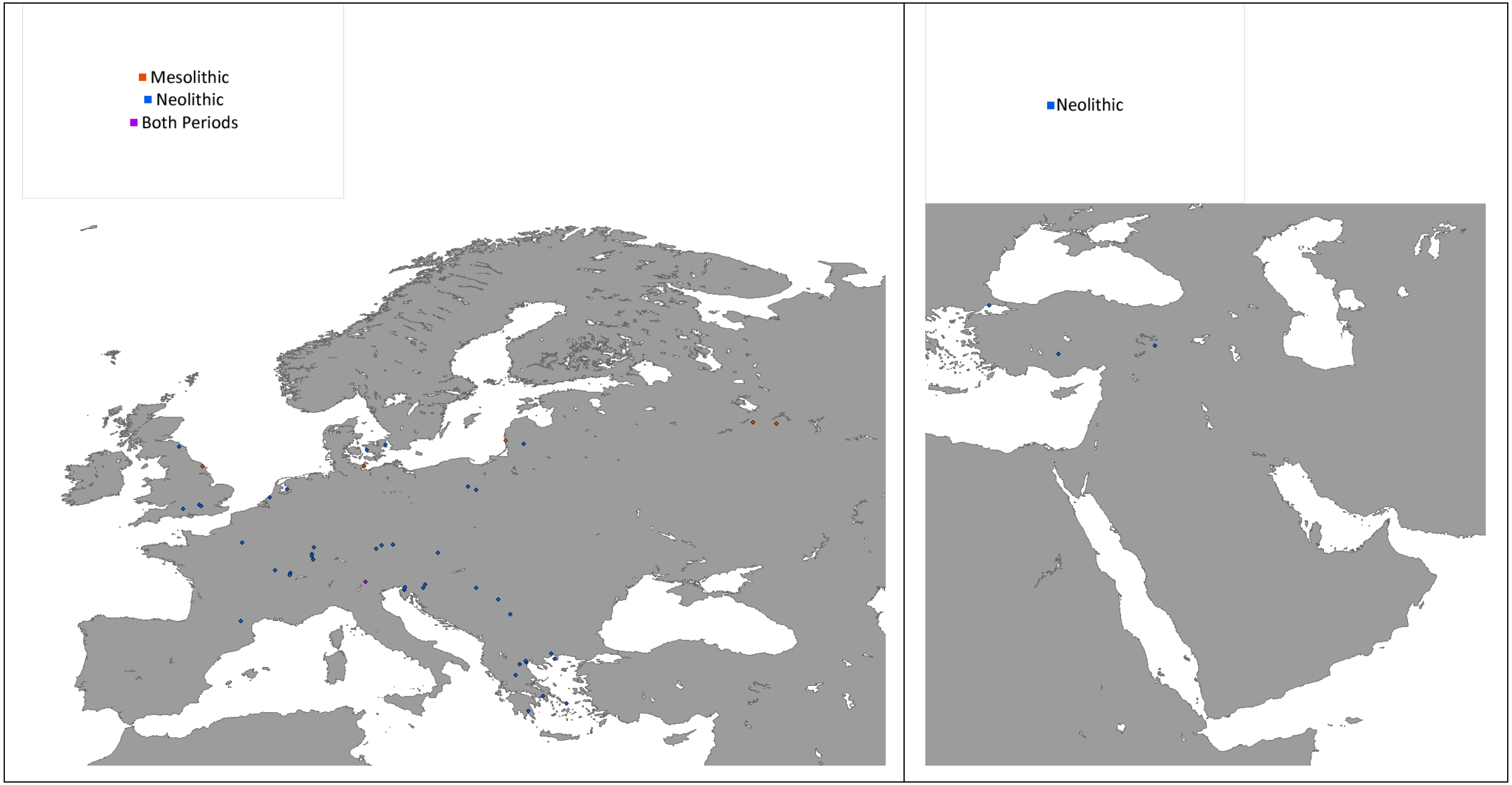


Figure 25. Distribution of beeswax on European and Near Eastern sites.

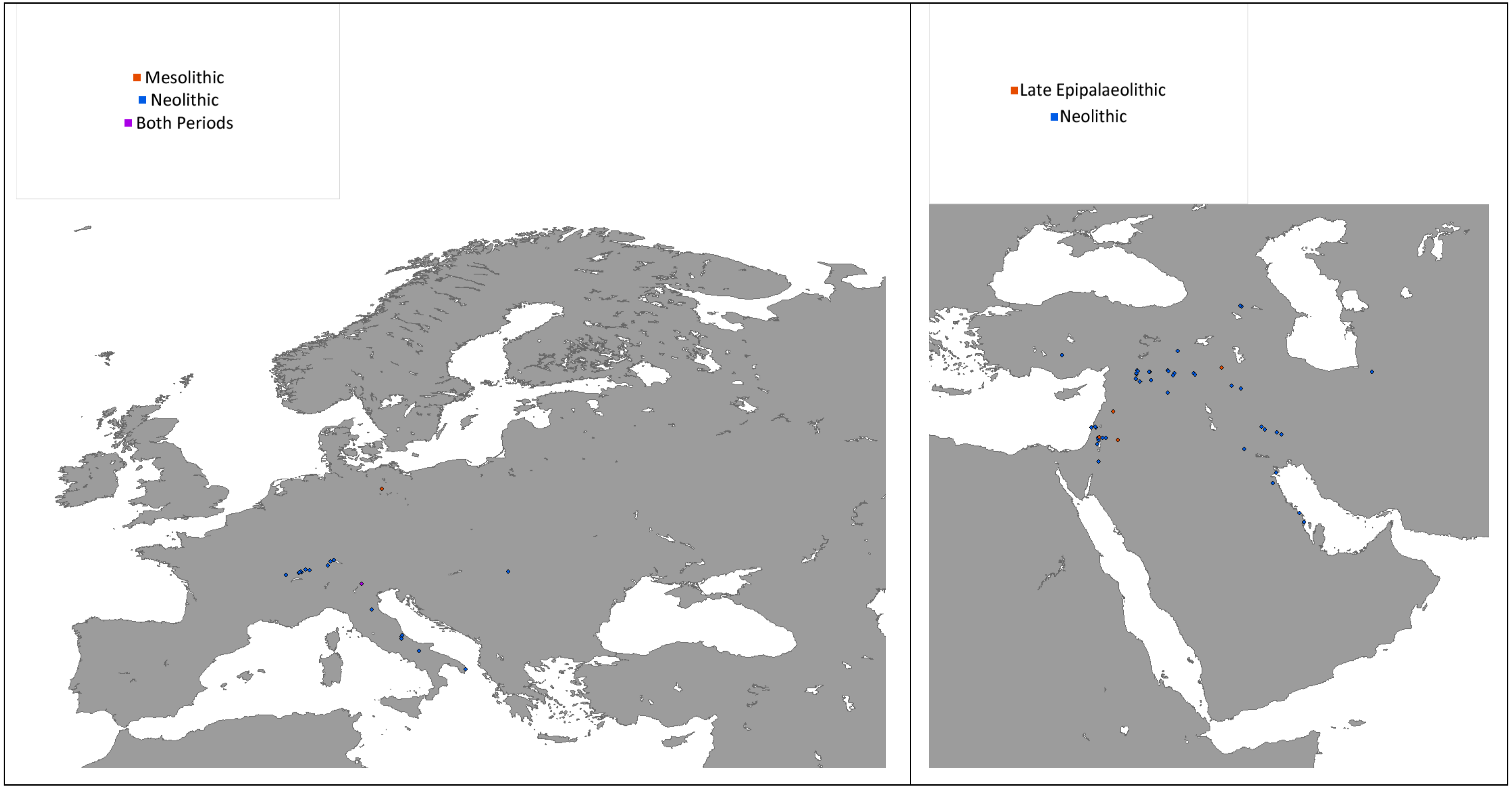


Figure 26. Distribution of bitumen on European and Near Eastern sites.

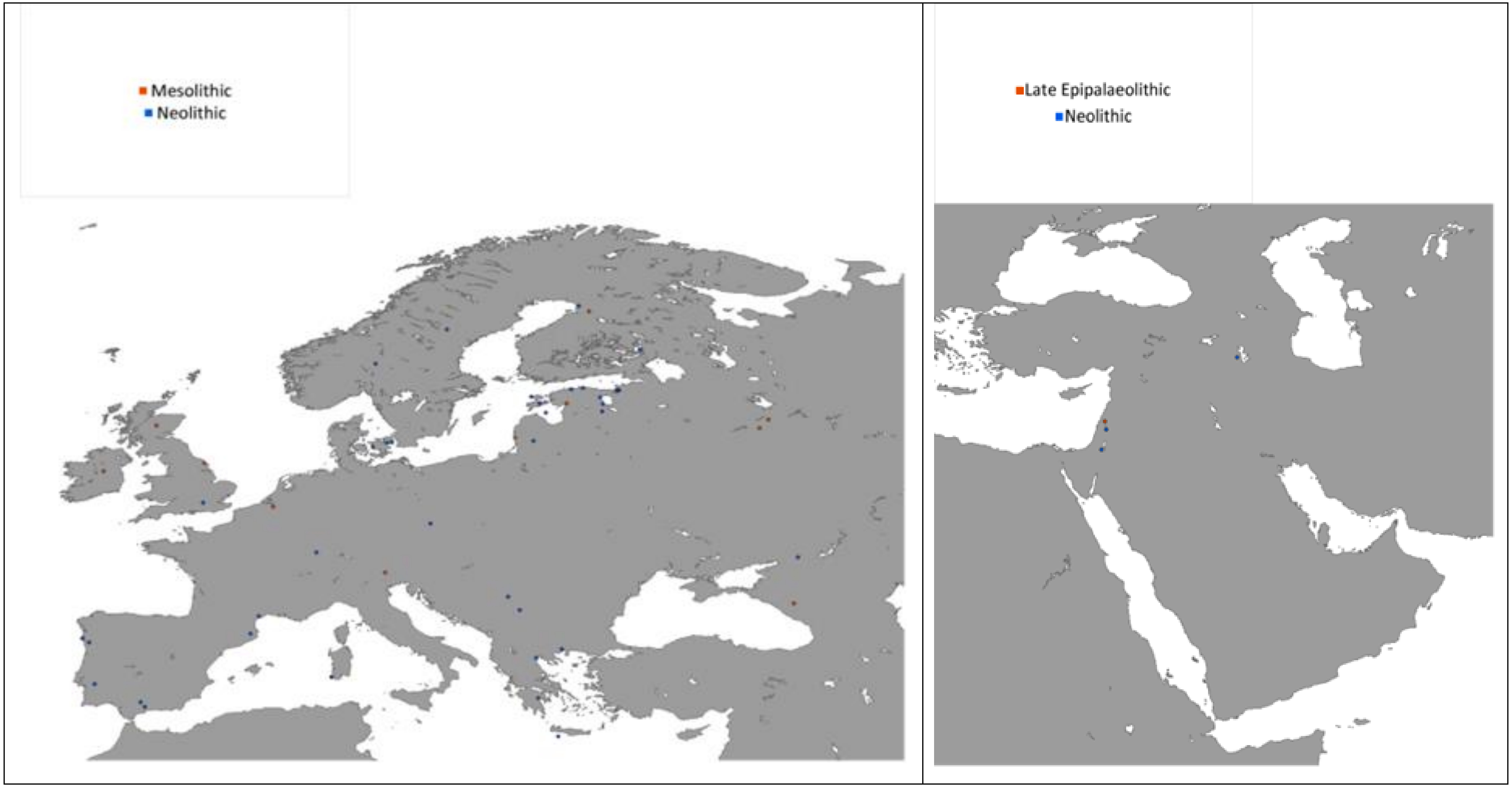


Figure 24. Distribution of tars on European sites.

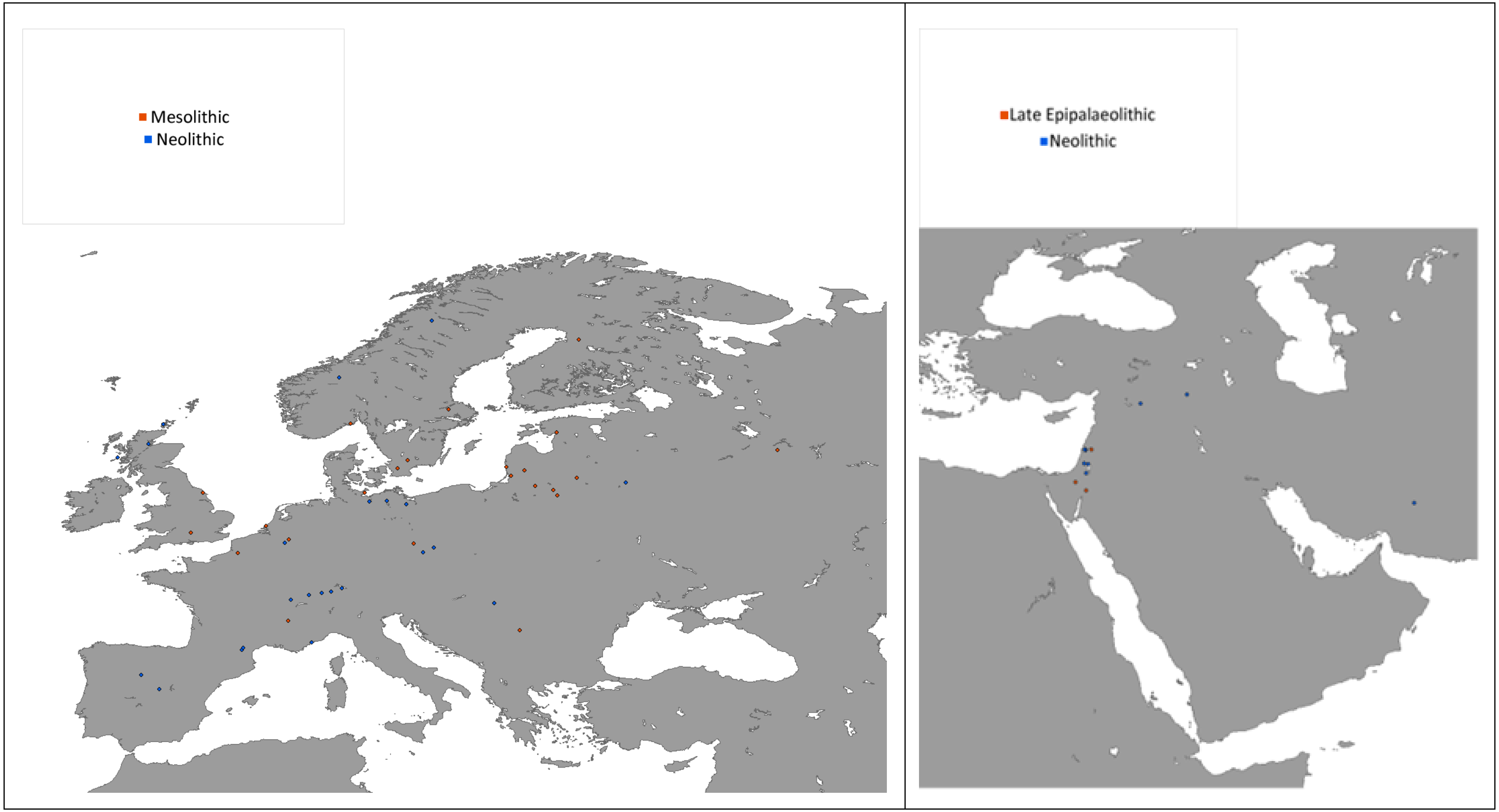


Figure 28. Distribution of unidentified adhesives on European and Near Eastern sites.

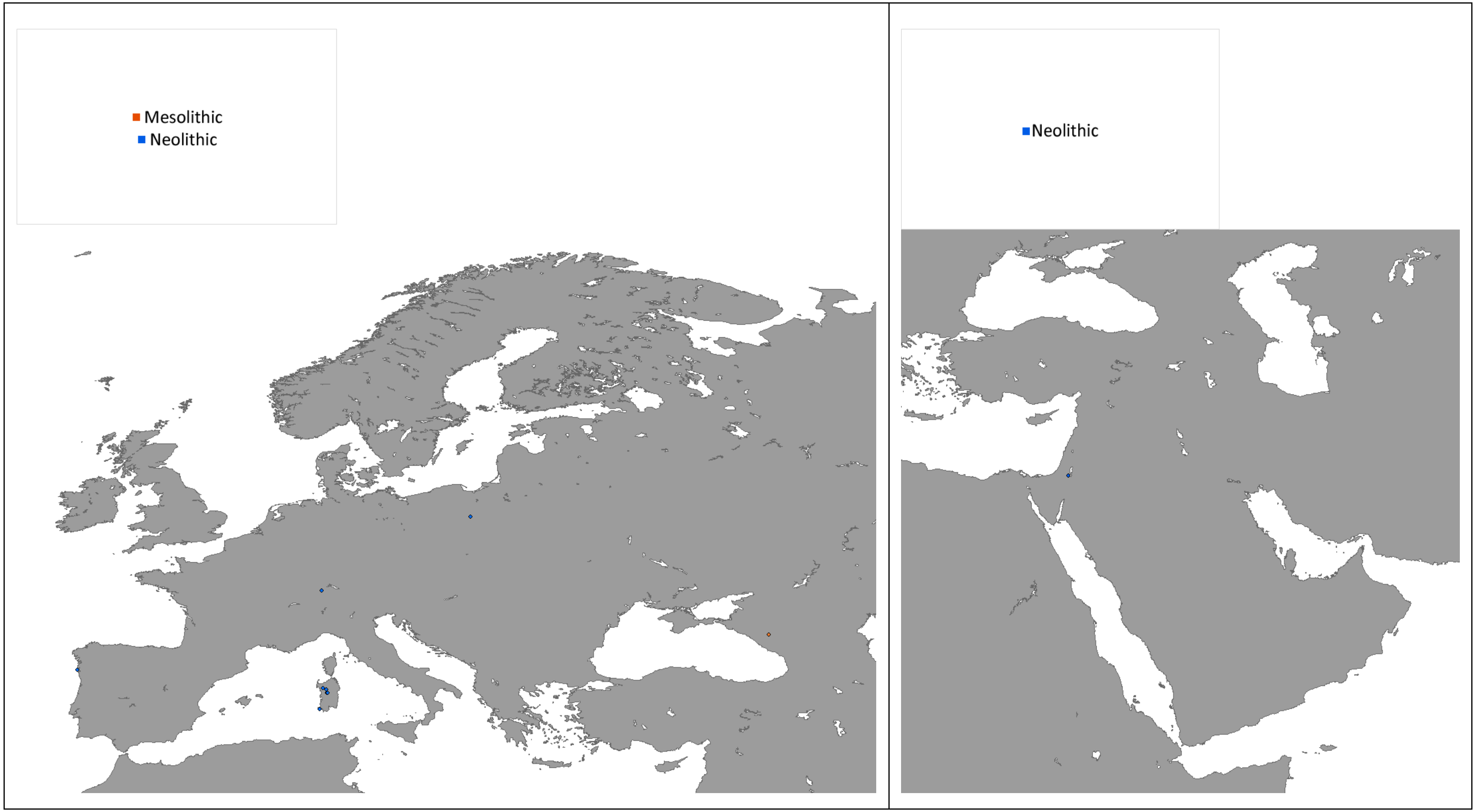


Figure 29. Distribution of animal glues on European and Near Eastern sites.

4.4: Analysis of Adhesive Classes

Most plaster has been identified without reference to analysis in both regions although the proportion of unanalysed sites is less for the Mesolithic period (Figure 33). Near Eastern studies exhibit greater use of analytical approaches – with the exception of chemical analysis.

The vast majority of tars have been chemically analysed (70.4%) with greater use of this approach in Neolithic compared to Mesolithic studies (Figure 30). Optical microscopy and physical examination constitute smaller percentages of the overall total and have been predominantly used in assessing Mesolithic sites (Figures 31 and 32). Additionally, a greater number of Mesolithic sites have been analysed for tar without analysis than Neolithic sites (Figure 33).

Beeswax has almost wholly been identified via chemical analysis, with just a third of Mesolithic beeswax not chemically analysed (Figure 30). Significant proportions have also been analysed via optical microscopy or physical examination, although 8% has been identified without reference to analytical techniques (Figures 31-33). Such analyses are highly concentrated in the European Mesolithic with optical microscopy employed on two-thirds of all sites with beeswax.

Whilst chemical analysis has been employed to identify bitumen at a significant percentage of archaeological sites, visual approaches (significantly physical examination) are utilised to a greater extent (Figures 30-32). Furthermore, a sizeable proportion (30%) of sites have identified bitumen without any form of analysis (Figure 33). Use of chemical analysis across Near Eastern and European sites is not significantly different for the Neolithic (31% vs 38.9%) but due to lower numbers of studies is heavily employed relatively in the Late Epipalaeolithic/Mesolithic (50% vs 100%). Use of both visual approaches is considerably more frequent in Near Eastern sites, though this is equally the case for no analysis.

Most resins and miscellaneous plant-based adhesives have been chemically analysed, with visual analysis types forming a smaller component (Figures

30-32). Only 17.8% had not undergone some form of analysis (Figure 33). Significant regional and temporal differences are present in the types of analysis performed on resins – 77.6% of European sites were examined directly compared with 50% of Near Eastern ones. Due to lower study numbers, a higher percentage of Near Eastern sites have been analysed visually or not at all. In Europe, less use is made of chemical analysis at Mesolithic sites compared to the Neolithic and its use is entirely absent in the Near Eastern Late Epipalaeolithic. Instead, in Europe, proportionally greater use is made of visual approaches in Mesolithic studies.

Unidentified adhesives have largely been subject to visual approaches or no analysis (Figures 31-33). Chemical analysis has only been conducted on 15.6% of the total – just 8.7% in the European Neolithic and absent altogether in the Late Epipalaeolithic (Figure 30). Late Epipalaeolithic and Mesolithic studies have more employed optical microscopy (66.7% Late Epipalaeolithic; 53.6% European Mesolithic) whilst – by comparison – Neolithic unidentified adhesives have either been analysed using physical examination or not at all.

All animal glues have been identified via chemical analysis, with some studies also employing visual approaches (Figures 30-32). One Near Eastern sample was also discussed without analysis (Figure 33).

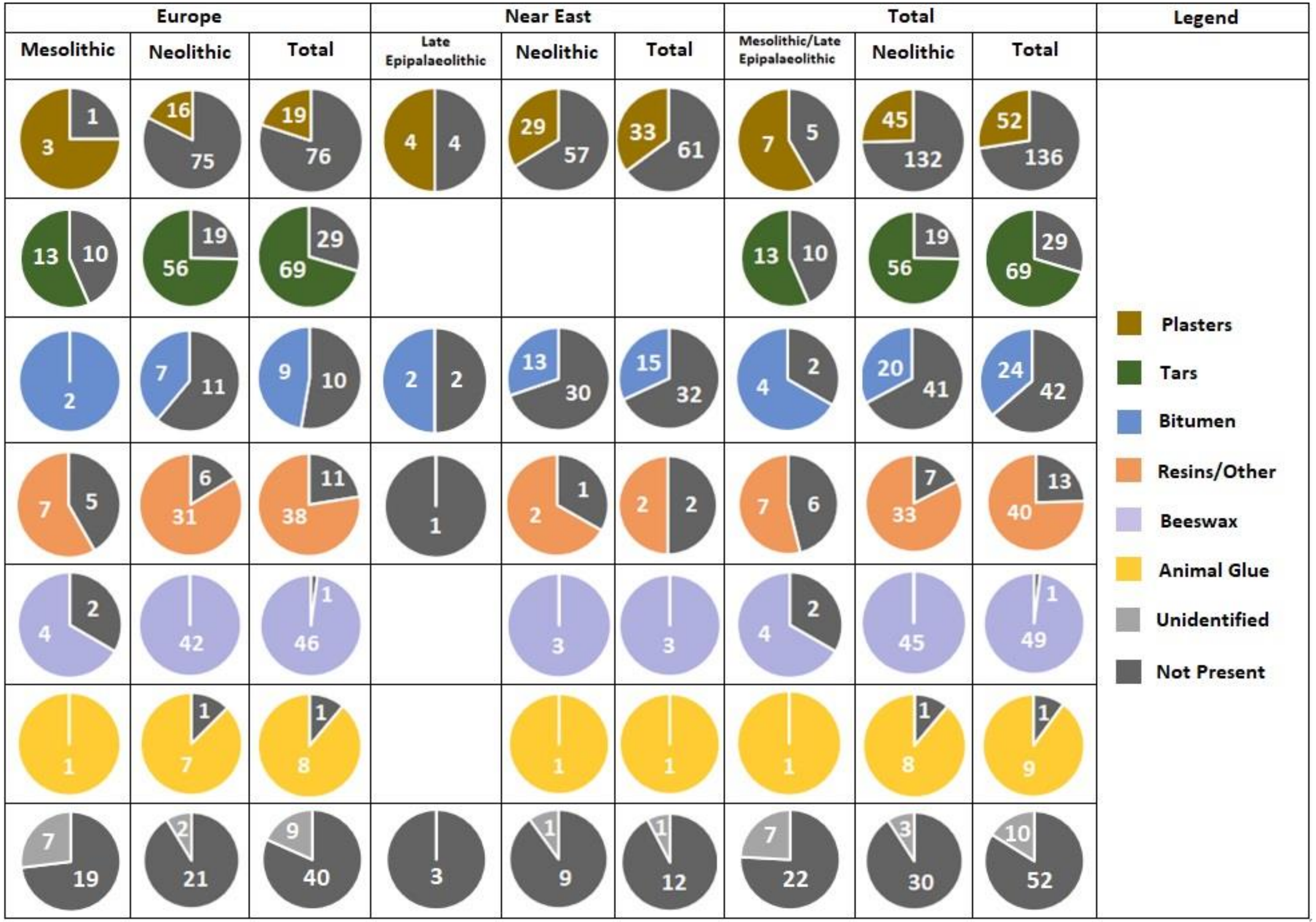


Figure 30. Use of chemical analysis by general class of adhesive, divided by region and period.

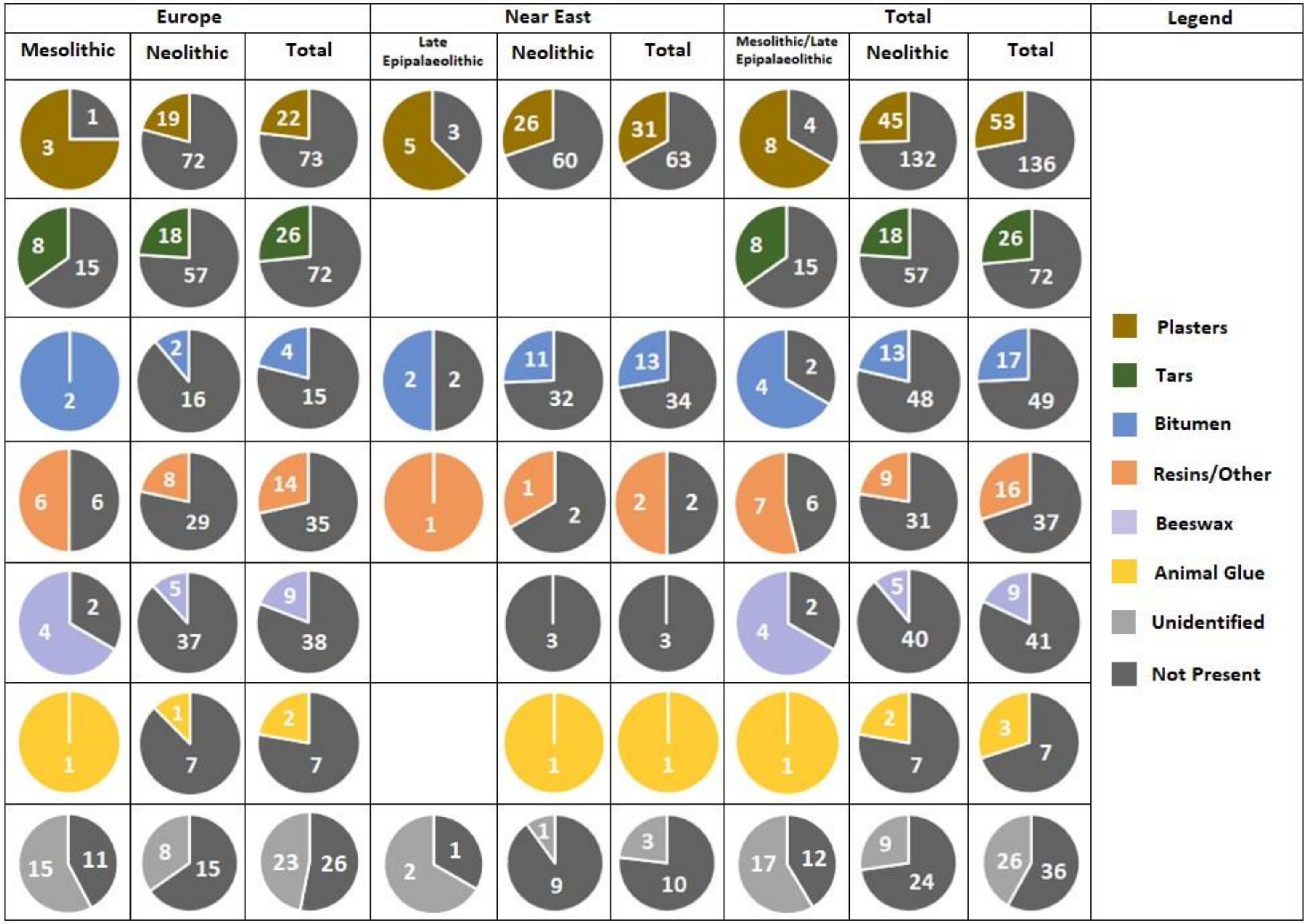


Figure 31. Use of optical microscopy by general class of adhesive, divided by region and period.

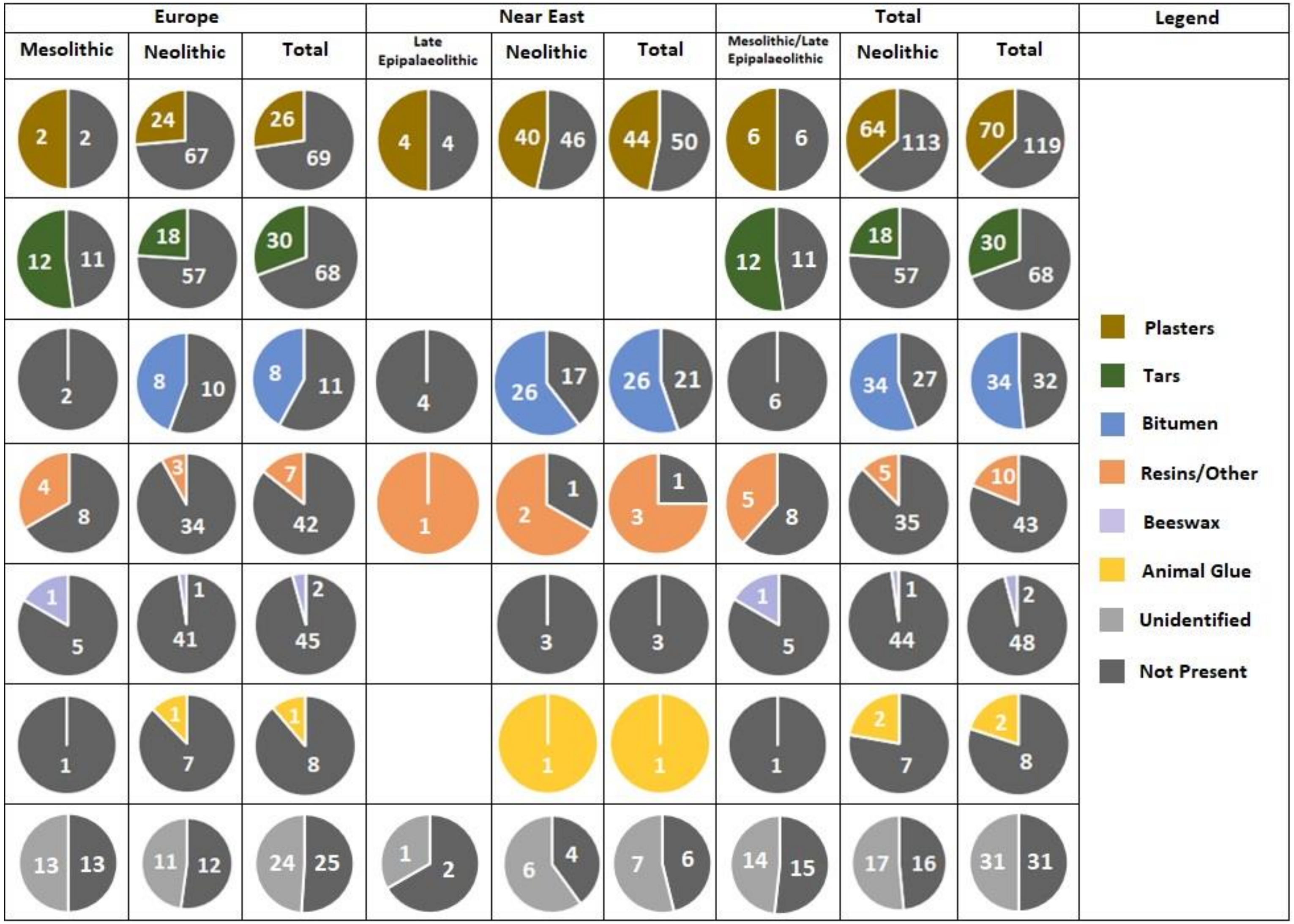


Figure 32. Use of physical examination by general class of adhesive, divided by region and period.

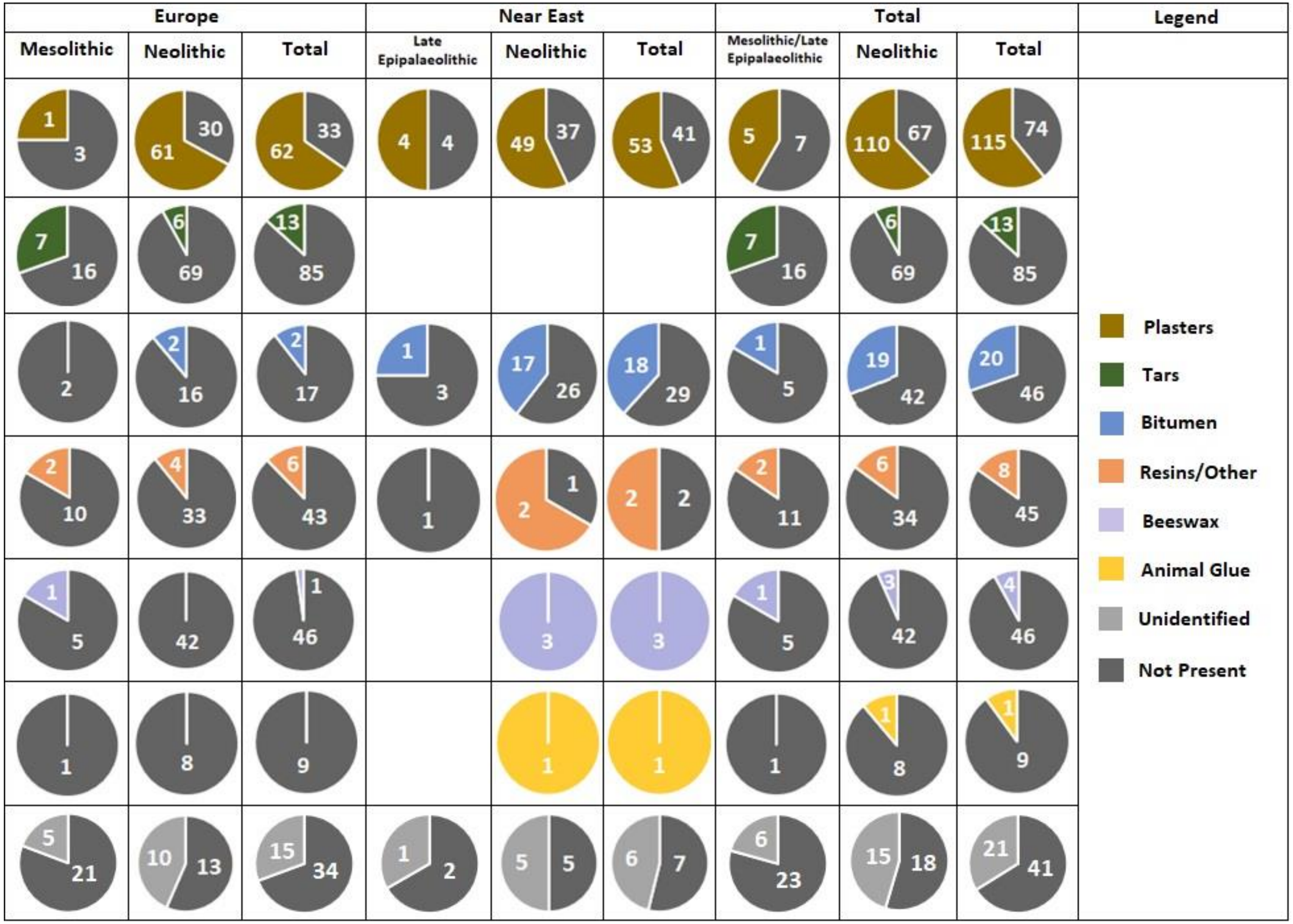


Figure 33. Use of no analysis by general class of adhesive, divided by region and period.

4.5: Overview of Adhesive Uses

575 general and 665 specific use indications were made across the 433 archaeological sites identified. Application constitutes the majority of general adhesive uses, with gluing and unknown uses also forming significant categories (Figure 35).

Differences are evident between periods – gluing dominates in the Mesolithic but is less prevalent in percentage terms in the Neolithic, despite little change in the amount of attested evidence (Figures 34 and 35). By contrast, application rises from only a small percentage of Mesolithic use to comprise the largest percentage of Neolithic use. Declines in use type are also evident – while chewing and processing/production form only small portions of the Mesolithic dataset, they decline further in the Neolithic. Greater diversity of general uses is attested regionally in Europe compared with Near Eastern sites – with burning/chewing totally absent from the latter. However, while chewing is present during both periods in Europe, burning is restricted to the Neolithic alone. Gluing and unknown uses increase significantly as a percentage of total uses in Europe compared to the Near East but only unknown uses exhibit corresponding increases in the number of sites. Application and manufacture meanwhile see significant declines when comparing European sites with Near Eastern ones.

Architectural roles constitute most application sub-uses with sealing forming the second largest category (Figure 36). Architectural roles form a greater percentage of Near Eastern evidence, forming sizeable majorities in comparison to Europe. Mesolithic application evidence is considerably less diverse than the Neolithic – with regional differences also present. European Mesolithic sites display twice the variety of sub-uses compared with Late Epipalaeolithic sites, whereas Neolithic sites in the Near East display 25% greater variety. Sealing also forms a greater percentage of Near Eastern Neolithic evidence despite its absence in Late Epipalaeolithic contexts. Conversely, container decoration is markedly higher in the European

Neolithic compared to the Near East, with object decoration also forming higher percentages in Europe, especially during the Mesolithic.

Evidence for burning derives solely from the European Neolithic – with incense comprising the majority use (Figure 37). Chewing subcategories are inherently more speculative due to a lack of definitive use contexts for chewed adhesives – with most interpreted as either medicinal or processing evidence (Figure 38). Although their relative ratios remain broadly identical between the Mesolithic and Neolithic, greater medicinal evidence derives from the Mesolithic. Hygienic use could be alternatively considered a subset of medicinal use. Unknown uses form a greater percentage of Neolithic interpretations compared with the Mesolithic.

Hafting comprises the vast majority of gluing evidence, with repairing a smaller but significant component (Figure 39). Other sub-uses each constitute smaller portions (>5% of the total each) – often represented by isolated examples. Hafting percentages remain constant across both periods in the Near East but decline in Neolithic Europe - mainly replaced by repairing. Neolithic Europe also shows an increase in object manufacture and container manufacture appears for the first time. Gluing for architectural purposes is restricted to the Near East, comprising the second largest category in both periods.

Manufacture as a general use assignment is predominantly represented by container manufacture, with object manufacture forming a significant secondary category (Figure 40). Shaping of adhesives for the purposes of sealing or storage constitute smaller elements. Manufacture evidence is overwhelmingly derived from Near Eastern Neolithic contexts, which follows the overall split, except for storage which is absent. Only isolated examples are attested from the European Mesolithic (storage) and Neolithic (container manufacture).

Processing and production form broadly similar proportions of their joint category (Figure 41). Clear regional differences are present, with production dominating Near Eastern evidence and processing comprising the majority of European evidence in both periods.

Unknown uses have almost no identifiable sub-uses, dominated by adhesive lumps or unidentifiable traces on ceramics and lithics (Figure 42). Where suggested, no individual sub-use constitutes more than 5.3% of the total. These appear largely speculative, except for some sub-uses like flavouring and preservatives detected on ceramic sherds that do not fit neatly into other categories. Greater specific sub-use identification is made in Near Eastern sites compared with Europe in the Neolithic. However, no sub-uses are attested for the Late Epipalaeolithic compared to two European Mesolithic examples.

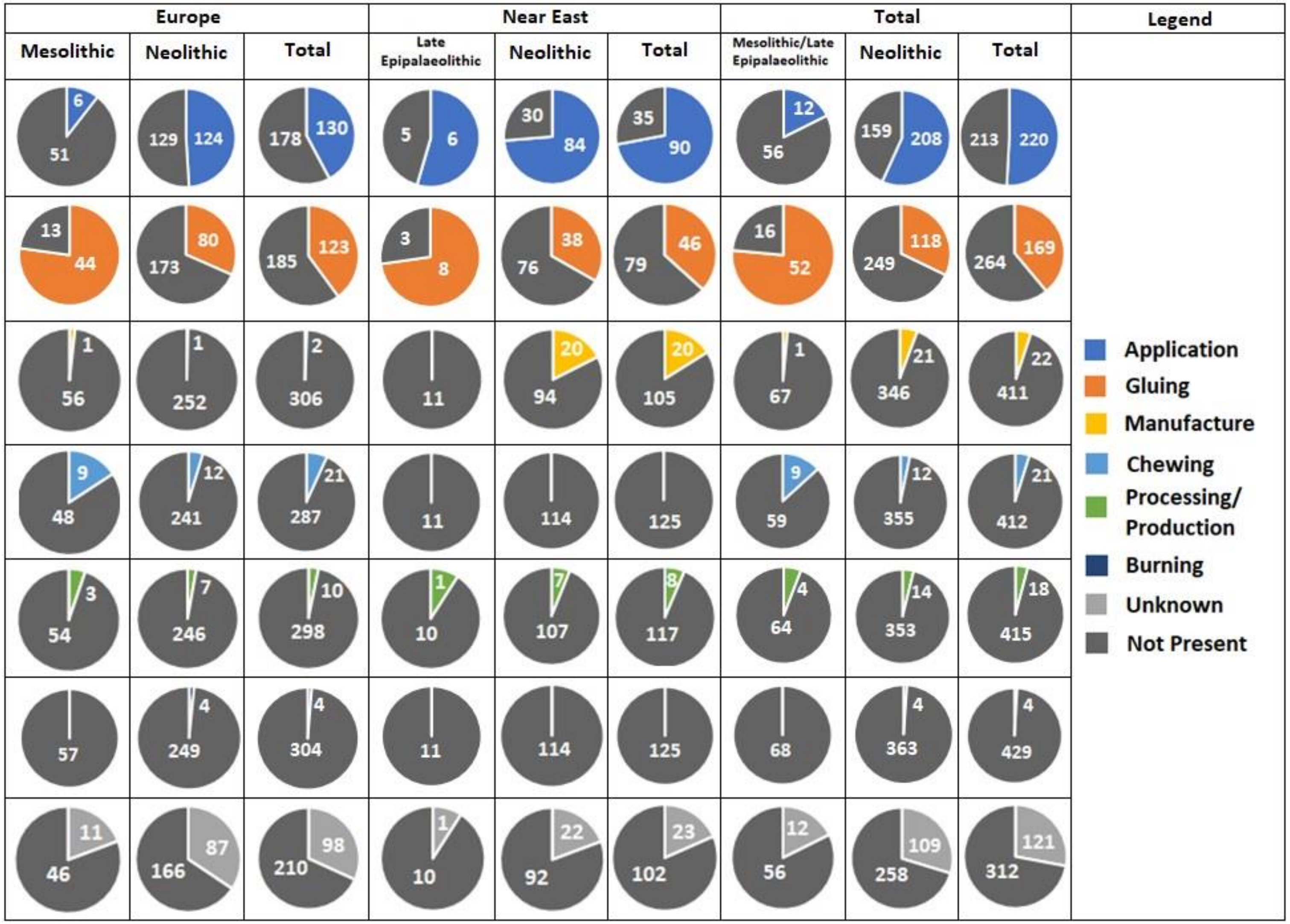


Figure 34. General adhesive use indications by number of sites, divided by region and period.

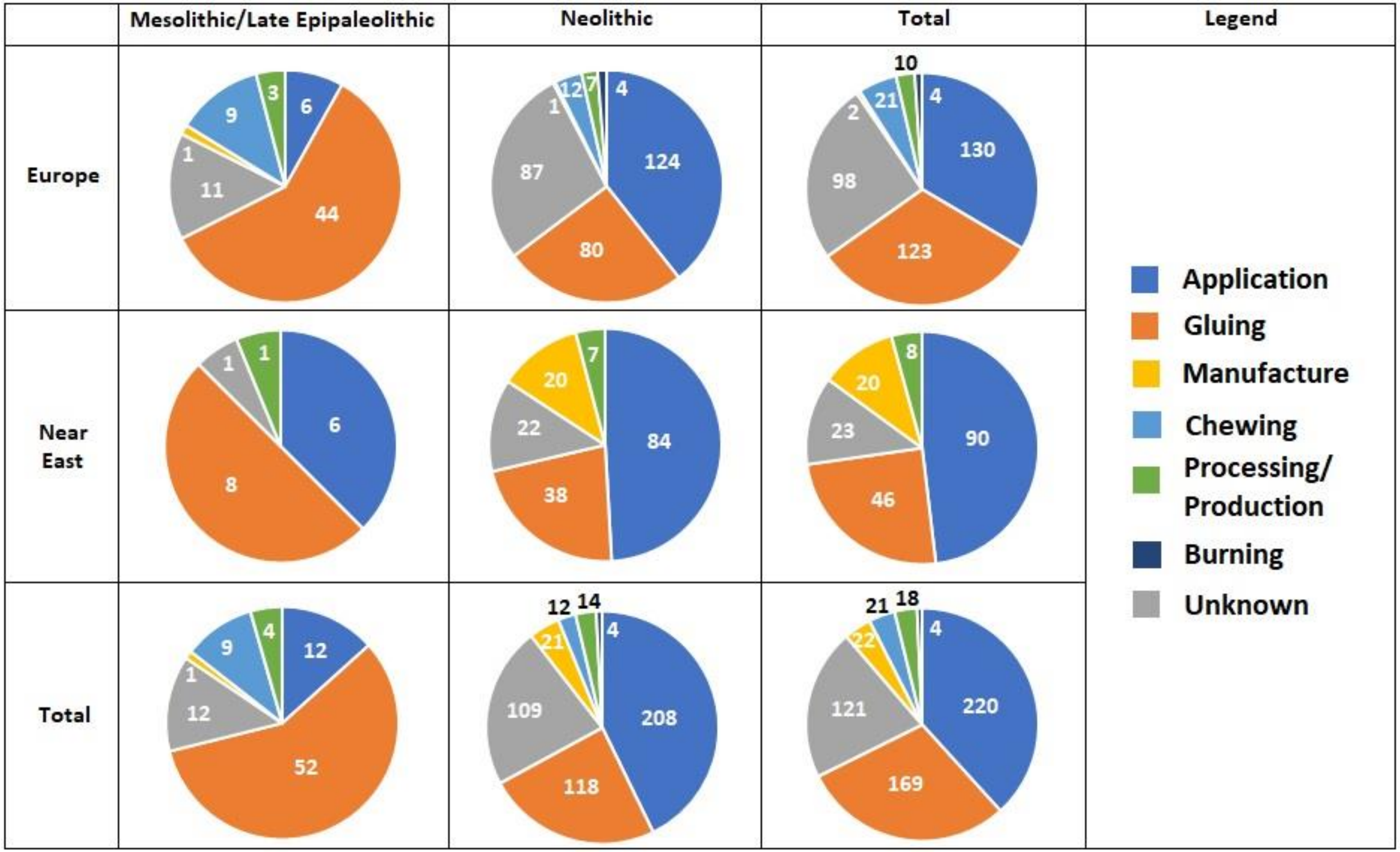


Figure 35. General adhesive use indications, divided by region and period.

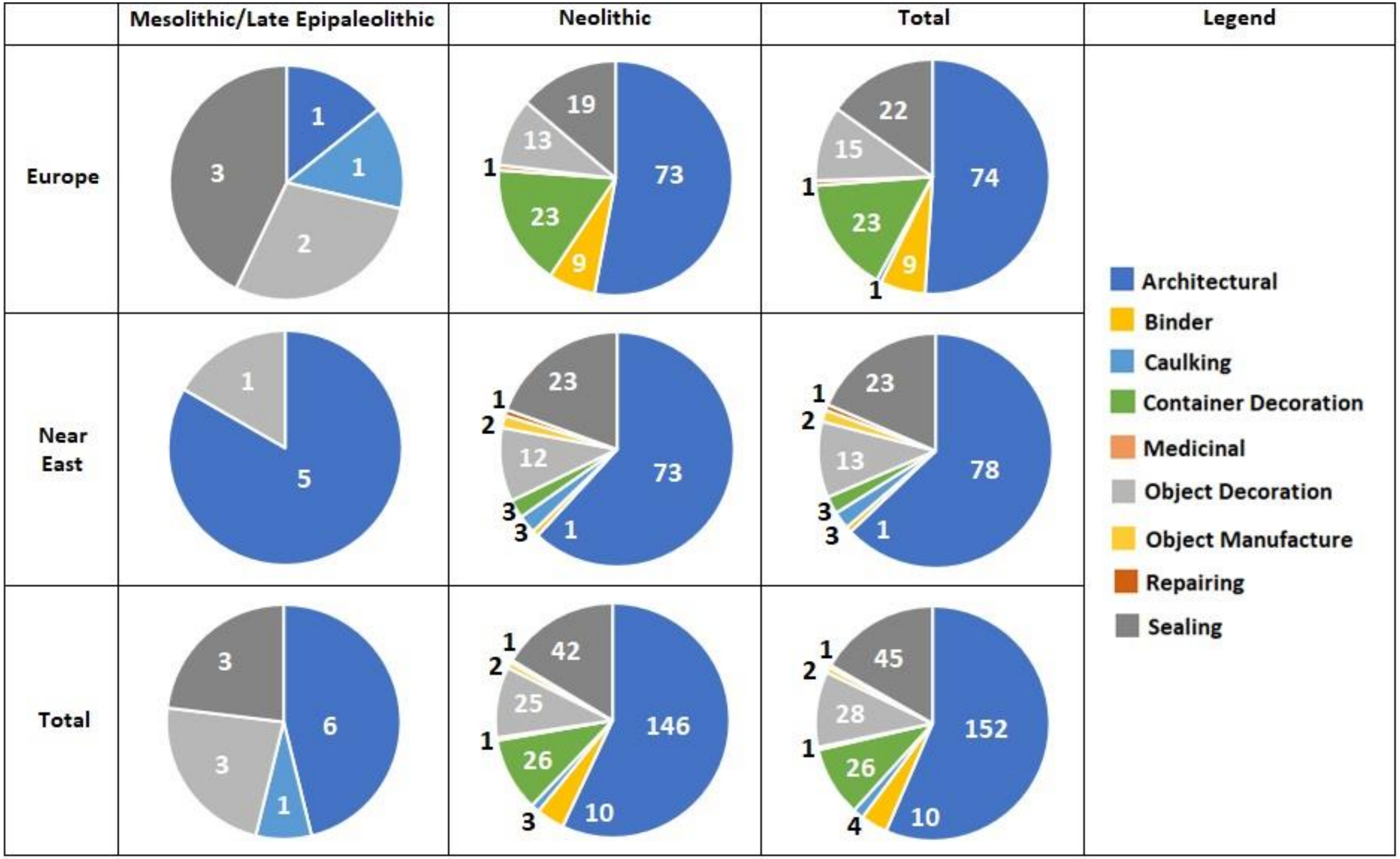


Figure 36. Specific application use indications, divided by region and period.

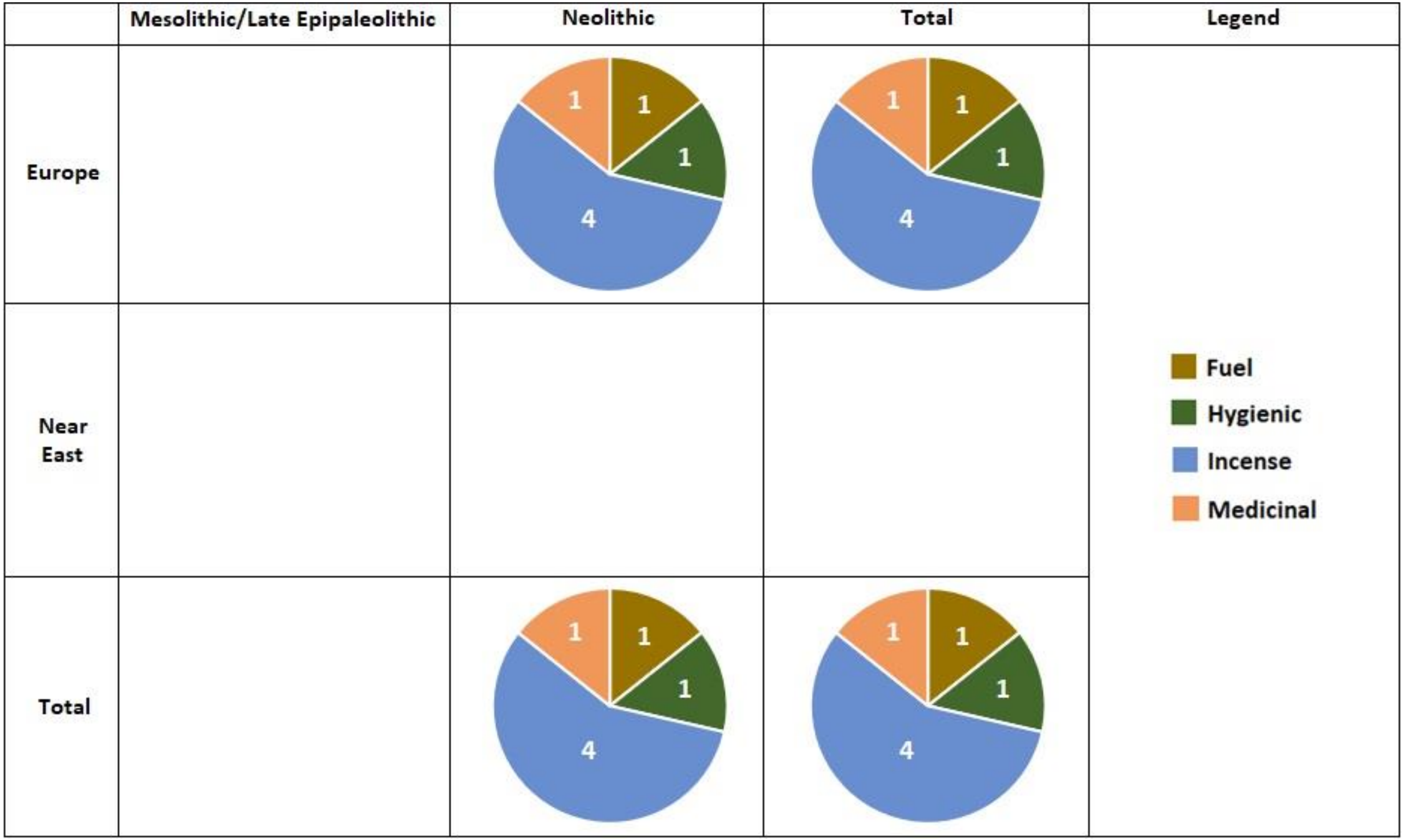


Figure 37. Specific burning use indications, divided by region and period.

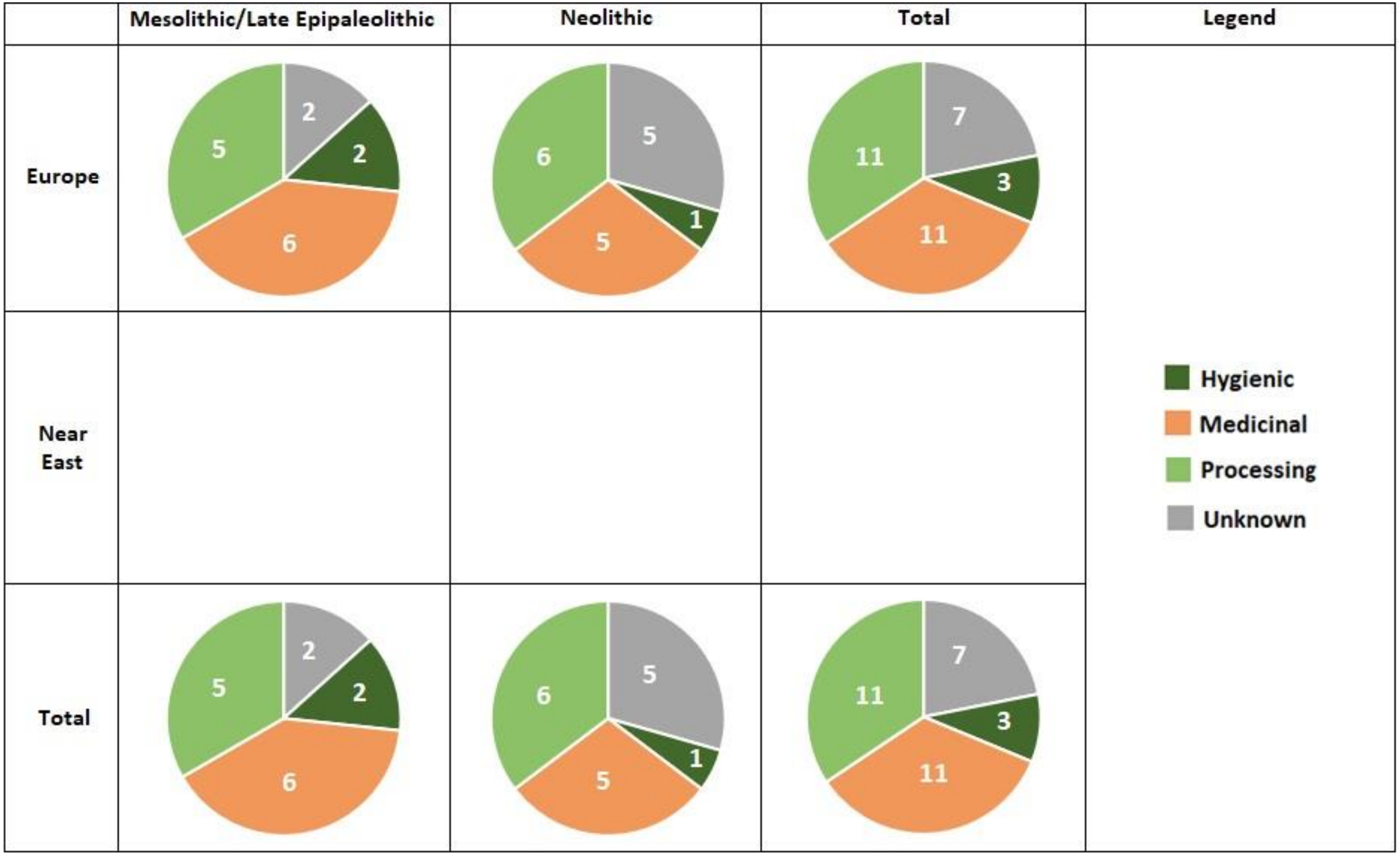


Figure 38. Specific chewing use indications, divided by region and period.

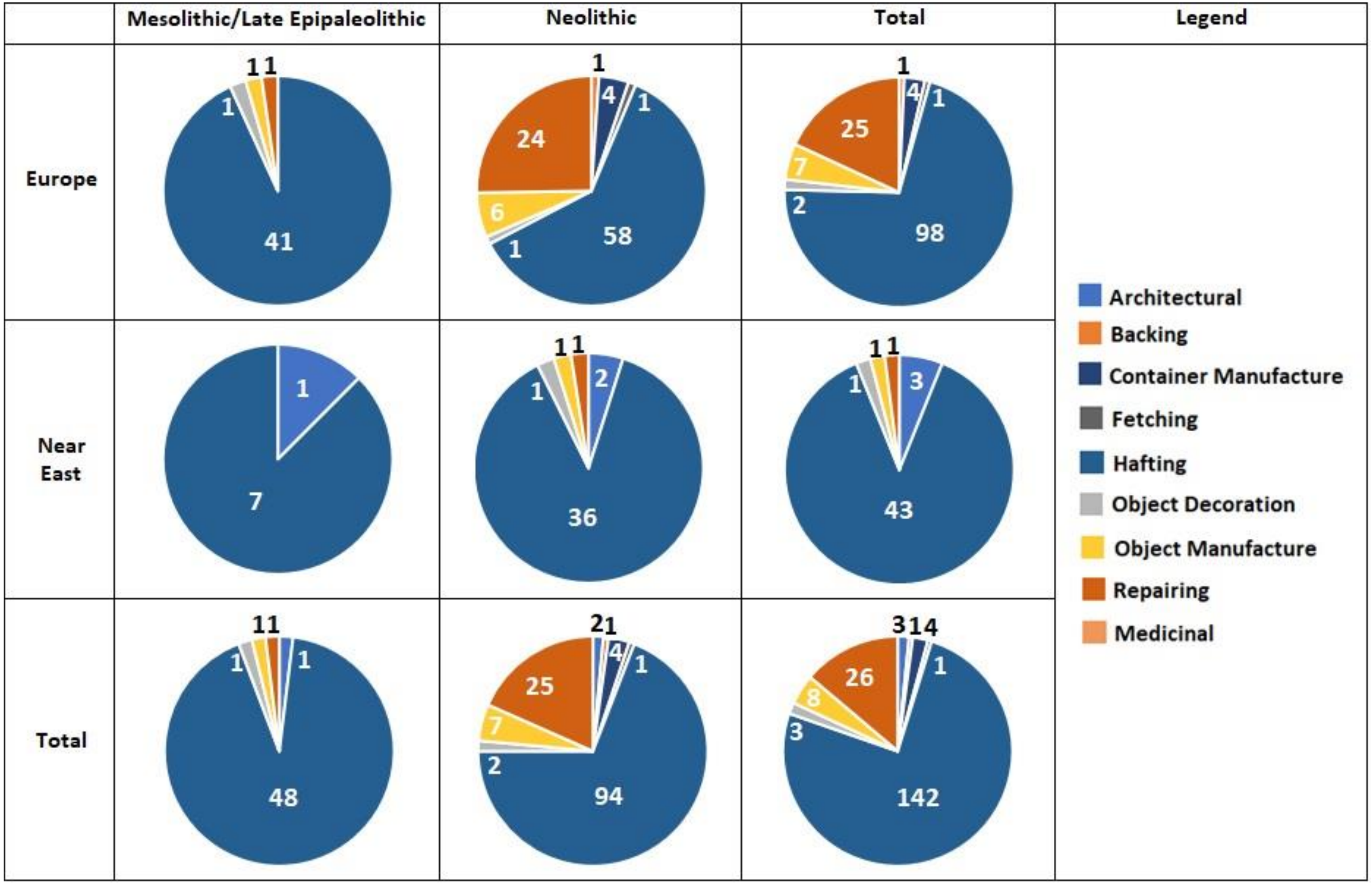


Figure 39. Specific gluing use indications, divided by region and period.

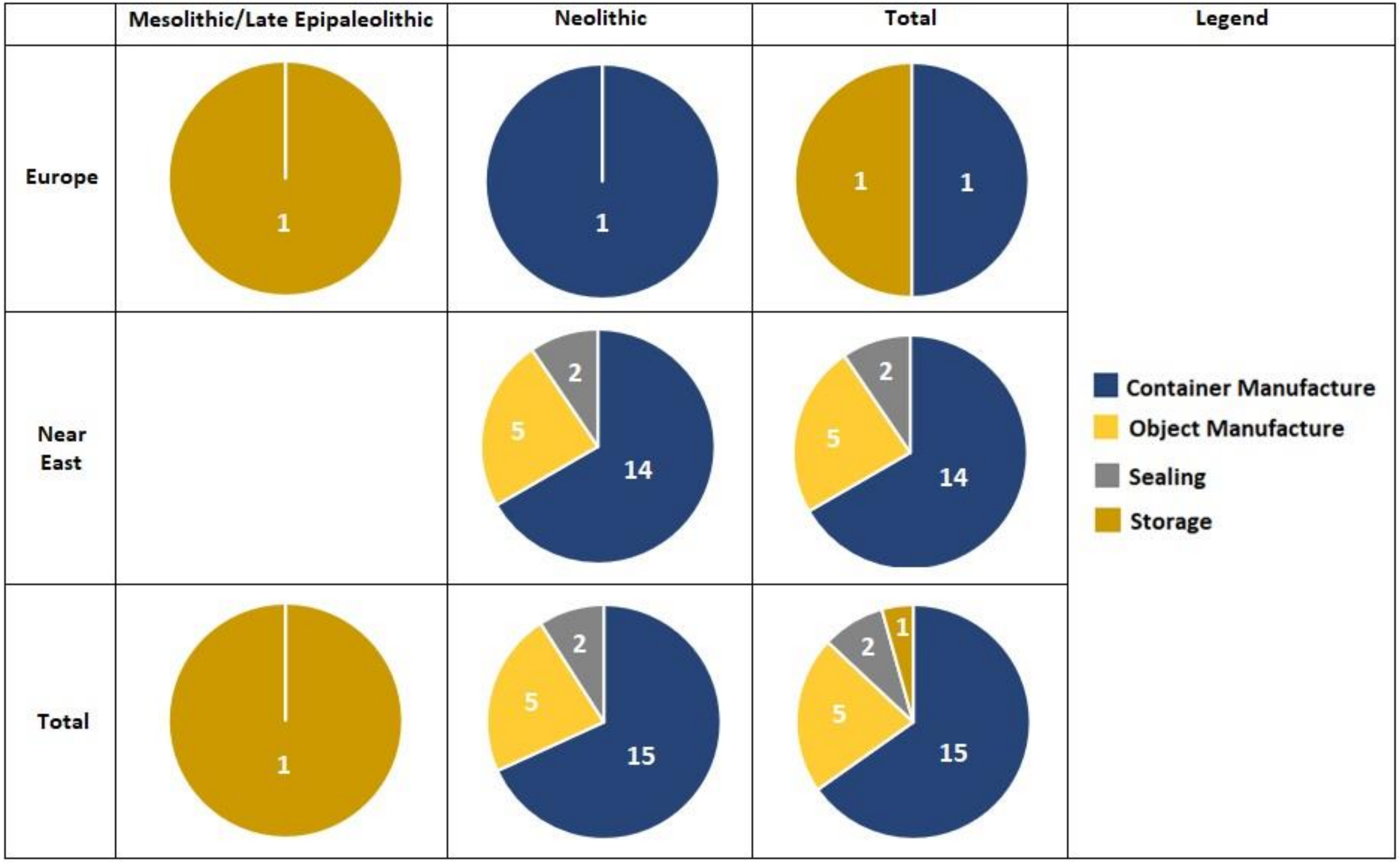


Figure 40. Specific manufacture use indications, divided by region and period.

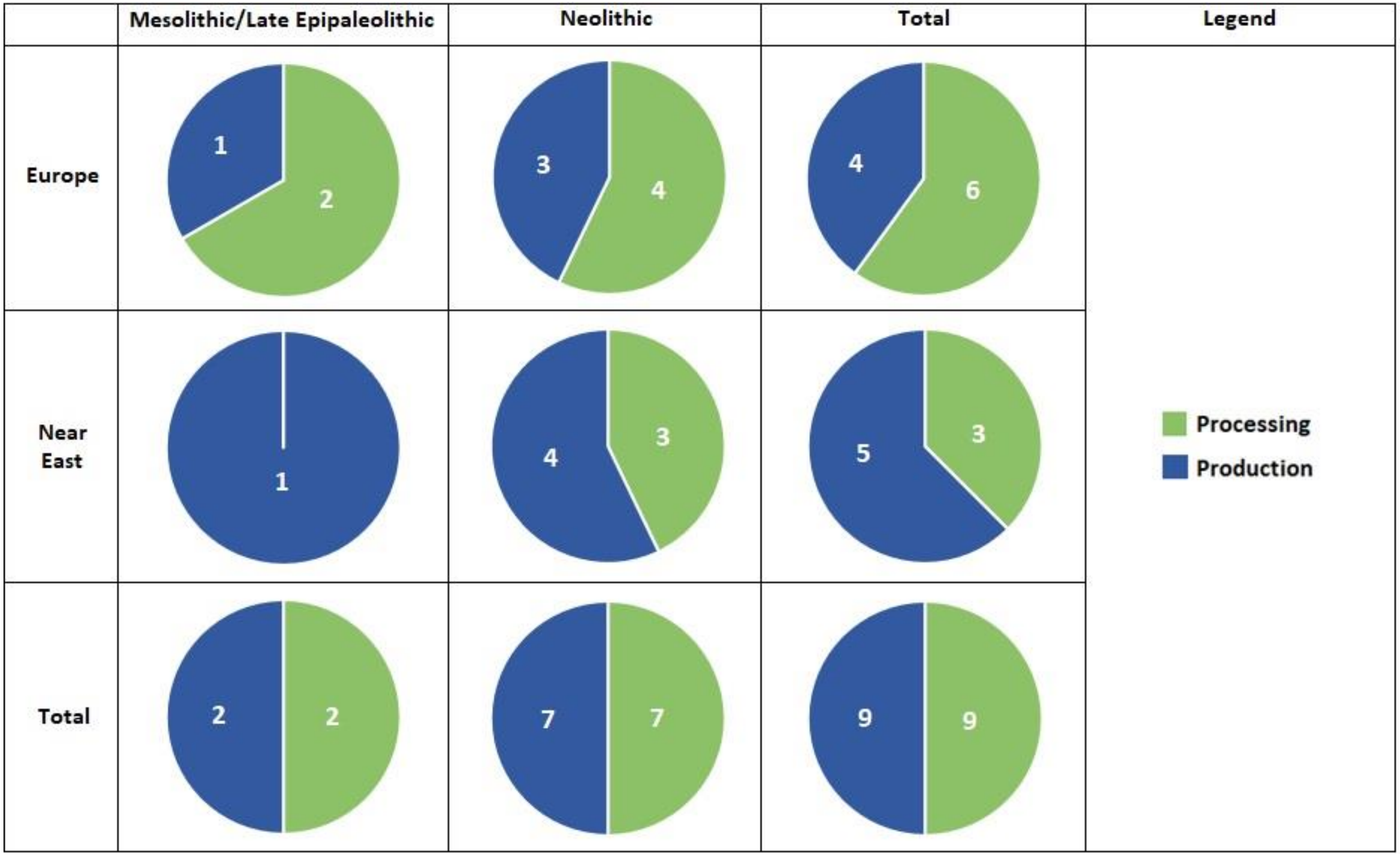


Figure 41. Specific processing/production use indications, divided by region and period.

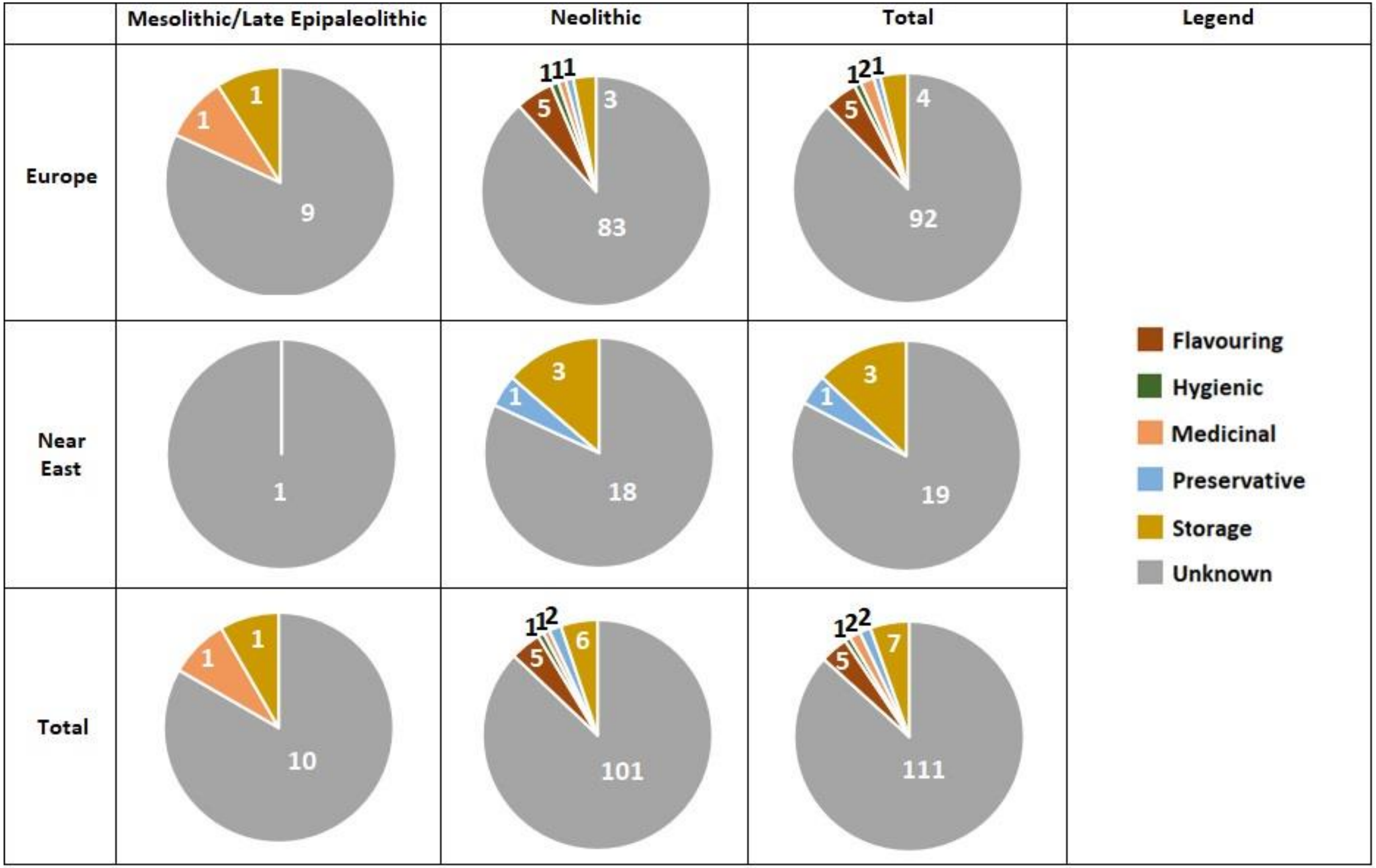


Figure 42. Specific unknown use indications, divided by region and period.

4.6: Distribution of Adhesive Uses

Application evidence overall largely correlates to the overall distribution of sites in each region, except Scandinavia where it is practically absent (Figure 43). Of this, architectural use is heavily restricted to Eastern Europe (Czechia, Poland, the Balkans and Greece) with isolated examples from Denmark, Western Europe and Italy, whereas Near Eastern evidence is more broadly distributed. Object decoration is largely concentrated in Iberia and Sardinia (corresponding with binder sub-use) with scattered Swiss and Lithuanian examples (the latter, Mesolithic). Near Eastern examples cluster in the Southern Levant, with isolated cases in Eastern Syria, Turkey and Iran (Figure 43). Evidence for container decoration is loosely scattered across Central and Eastern Europe with just a handful of examples in the Near East (Azerbaijan and Eastern Syria). Object manufacture and repairing are attested by isolated examples in the Near East located in the Southern Levant. Sealing (i.e., waterproofing) is heavily concentrated in the Levant and Eastern Syria, while more broadly distributed in Europe across Central Europe, Poland, the Balkans and Northern Greece. A single caulking example is attested in Sweden, whereas in the Near East it presents both in the Persian Gulf and one site in Eastern Syria. An isolated example of application evidence in a medicinal context is attested from Slovenia (a dental filling).

Figure 44 demonstrates burning evidence is sparse and widely spread across Europe – in Northern Greece, Slovenia and the Channel Islands. Fuel, hygienic and medicinal use is suggested solely by one Northern Greece site. Chewing is concentrated in Central Europe, Scandinavia and Finland (Figure 45). While Scandinavian evidence is almost entirely Mesolithic, Central European examples are largely Neolithic and Finnish mixed. Hygienic, medicinal and processing interpretations are largely Scandinavian, with significant proportions of Central European and Finnish evidence not attributed specific sub-uses.

Gluing is heavily restricted to Central Europe (Switzerland, Southern Germany and Czechia), Southern Sweden and the Baltic – with isolated examples elsewhere (Figure 46). Central/Southern European evidence is mostly Neolithic, apart from a Northern Italian cluster and isolated Serbian and Southern Russian examples. Northern European evidence is almost entirely Mesolithic, apart from a handful of Norwegian and UK sites. Near Eastern evidence concentrates heavily in the Southern Levant and Eastern Syria, with Late Epipalaeolithic evidence almost entirely restricted to the Southern Levant (Figure 46). As the majority sub-use, hafting closely corresponds to the overall distribution in both regions, although sparser in Iberia and the Balkans. Repairing is confined to Europe, consisting of scattered examples across Central Europe and the Balkans, and isolated cases in Finland, Denmark and Portugal. A single Mesolithic example is attested from Denmark. Backing, fletching, object manufacture and container and object decoration are sparsely attested and largely restricted to Europe. Architectural gluing, however, is entirely concentrated within the Near East.

Manufacture evidence largely clusters in the Southern Levant in the Near East, with two isolated European instances (Figure 47). Scattered examples are attested from Eastern Syria, Western Iran and the Gulf. European examples comprise equally storage and container production, whereas most Near Eastern evidence consists of container manufacture (white ware) and objects such as plaster statues. Sealing is attested solely from two coastal Gulf sites. Processing/production has a moderate concentration on the northern edge of the Alps, with isolated examples in Eastern Europe and the Balkans (Figure 48). Near Eastern evidence is more significantly concentrated in the Central Levant, but still widely distributed - isolated examples exist in Southern Turkey, Azerbaijan and the Gulf (Figure 48). Production evidence is concentrated in the main clusters (Northern Alps and Central Levant) with processing evidence more widely diffused across both regions and absent from the Levant entirely.

Unknown uses are less concentrated, but clusters exist in Central Europe, Estonia, Hungary and Greece – with Mesolithic examples attested from the UK and Baltic (Figure 49). Near Eastern evidence shows a slight concentration in the Central Levant but is otherwise widely distributed

(Figure 49). The vast majority of interpreted sub-uses derive from Europe - flavouring evidence is widely scattered across Western Europe, with other roles consisting of isolated examples.

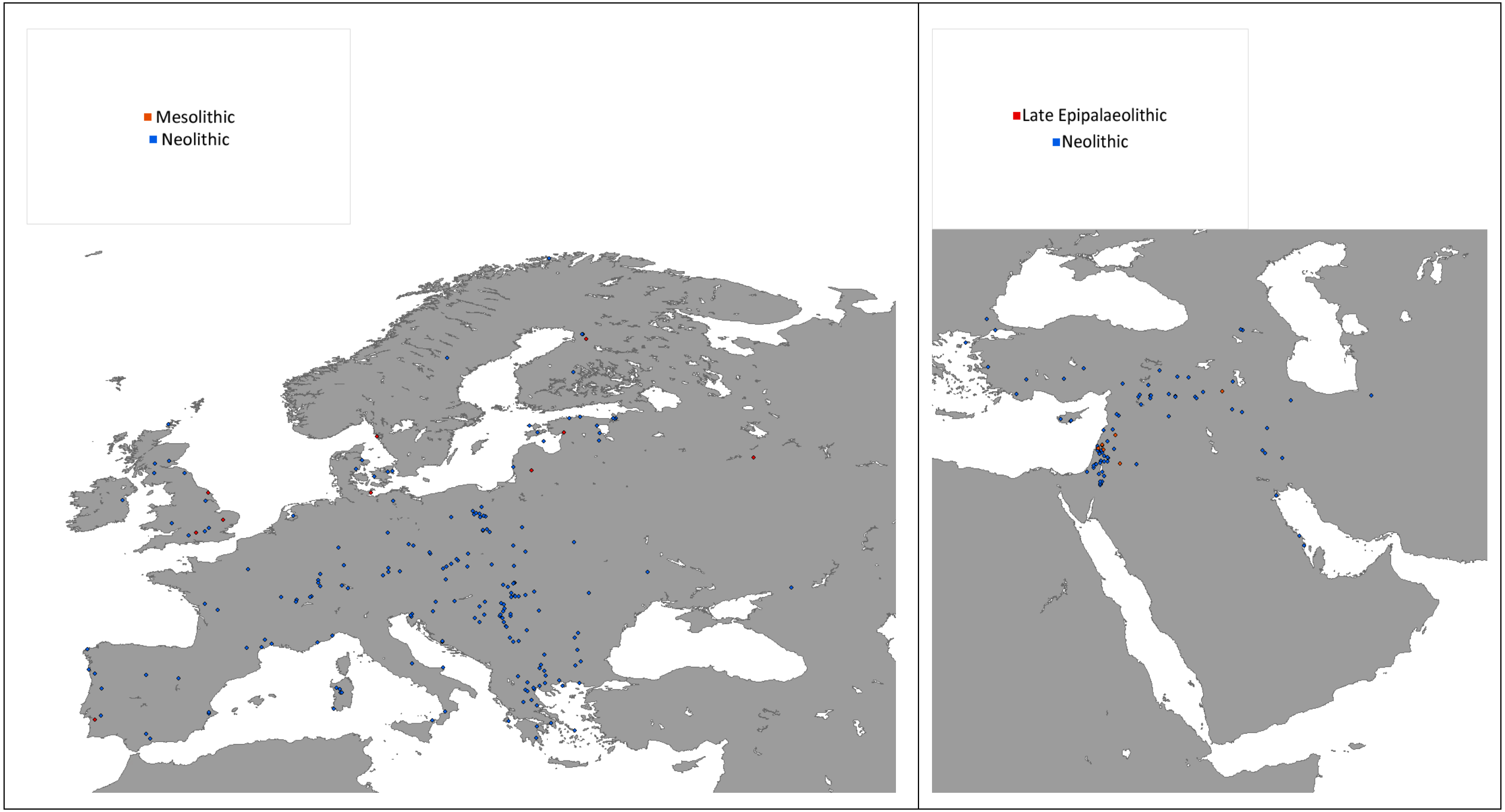


Figure 43. Distribution of application across European and Near Eastern sites.

Figure 44. Distribution of burning across European sites.

Figure 45. Distribution of chewing across European sites.

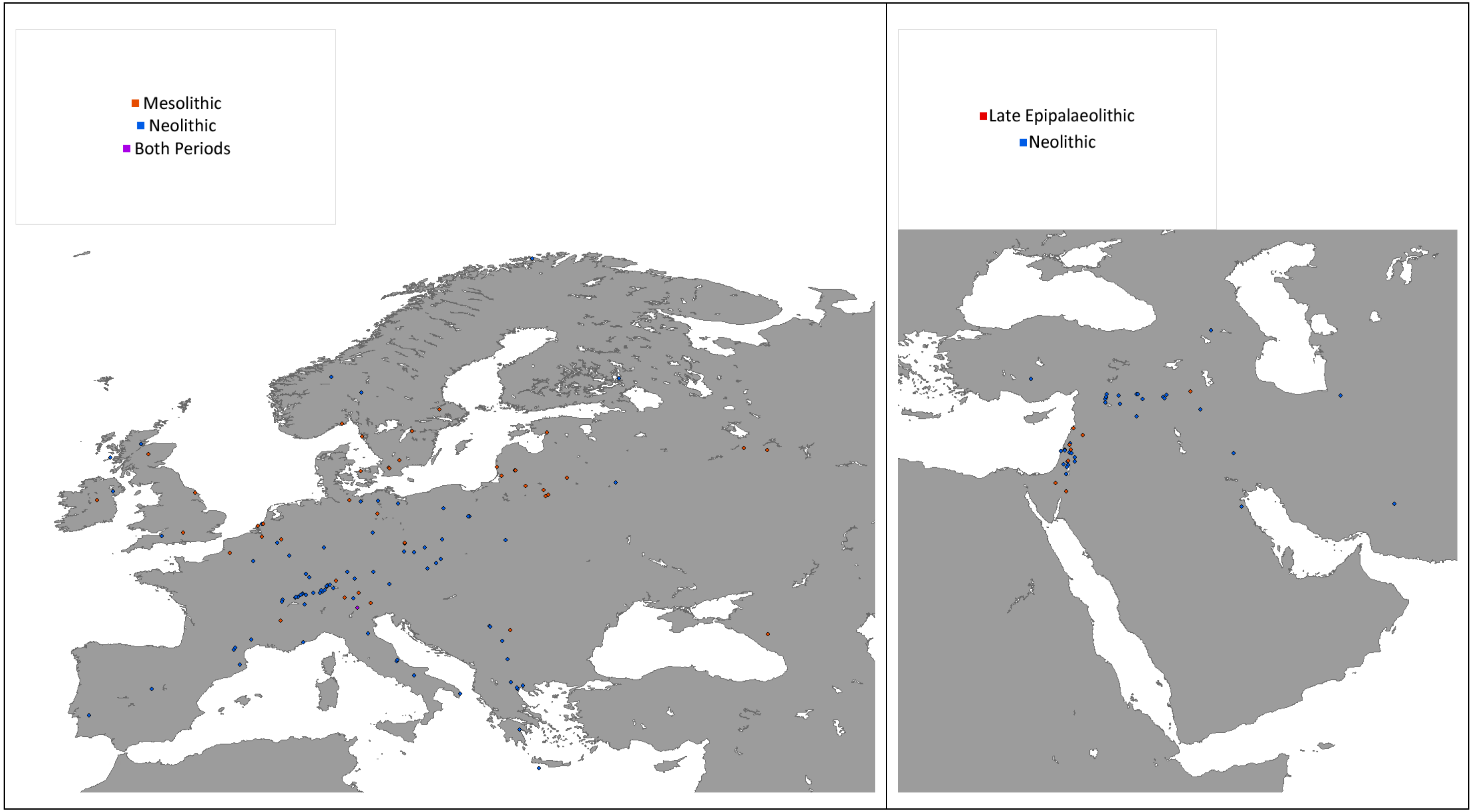


Figure 46. Distribution of gluing across European and Near Eastern sites.

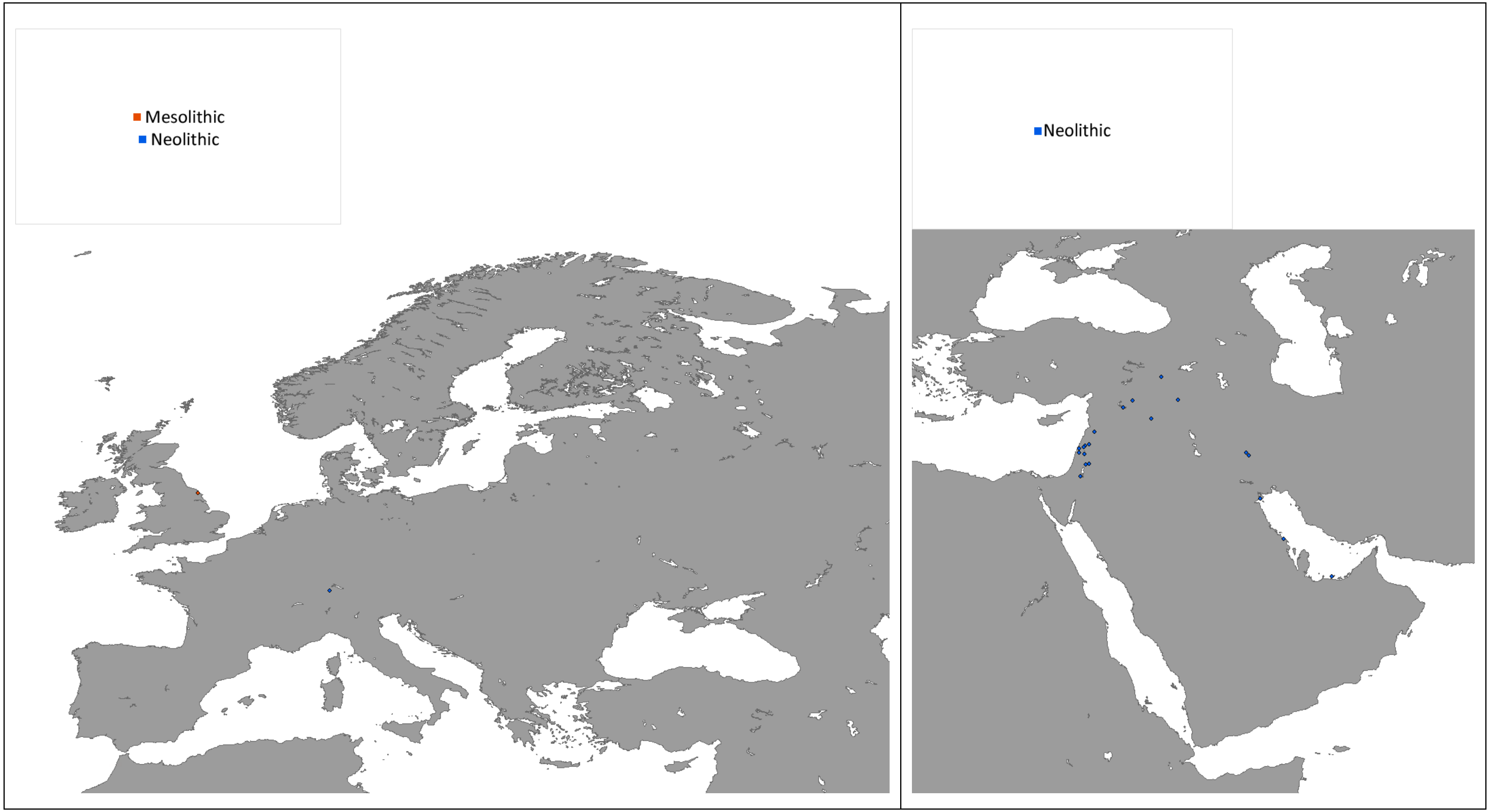


Figure 47. Distribution of manufacture across European and Near Eastern sites.

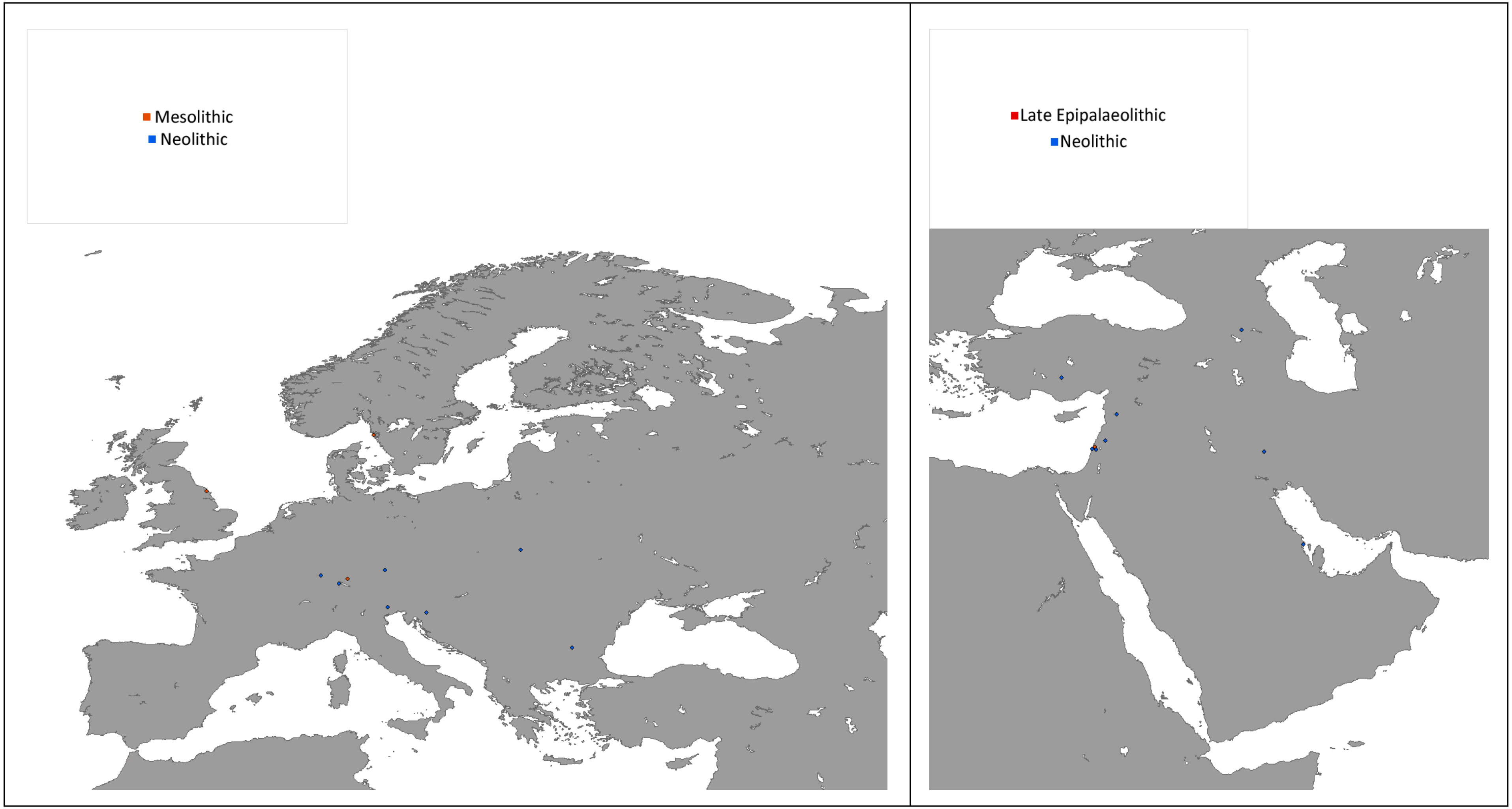


Figure 48. Distribution of processing/production across European and Near Eastern sites.

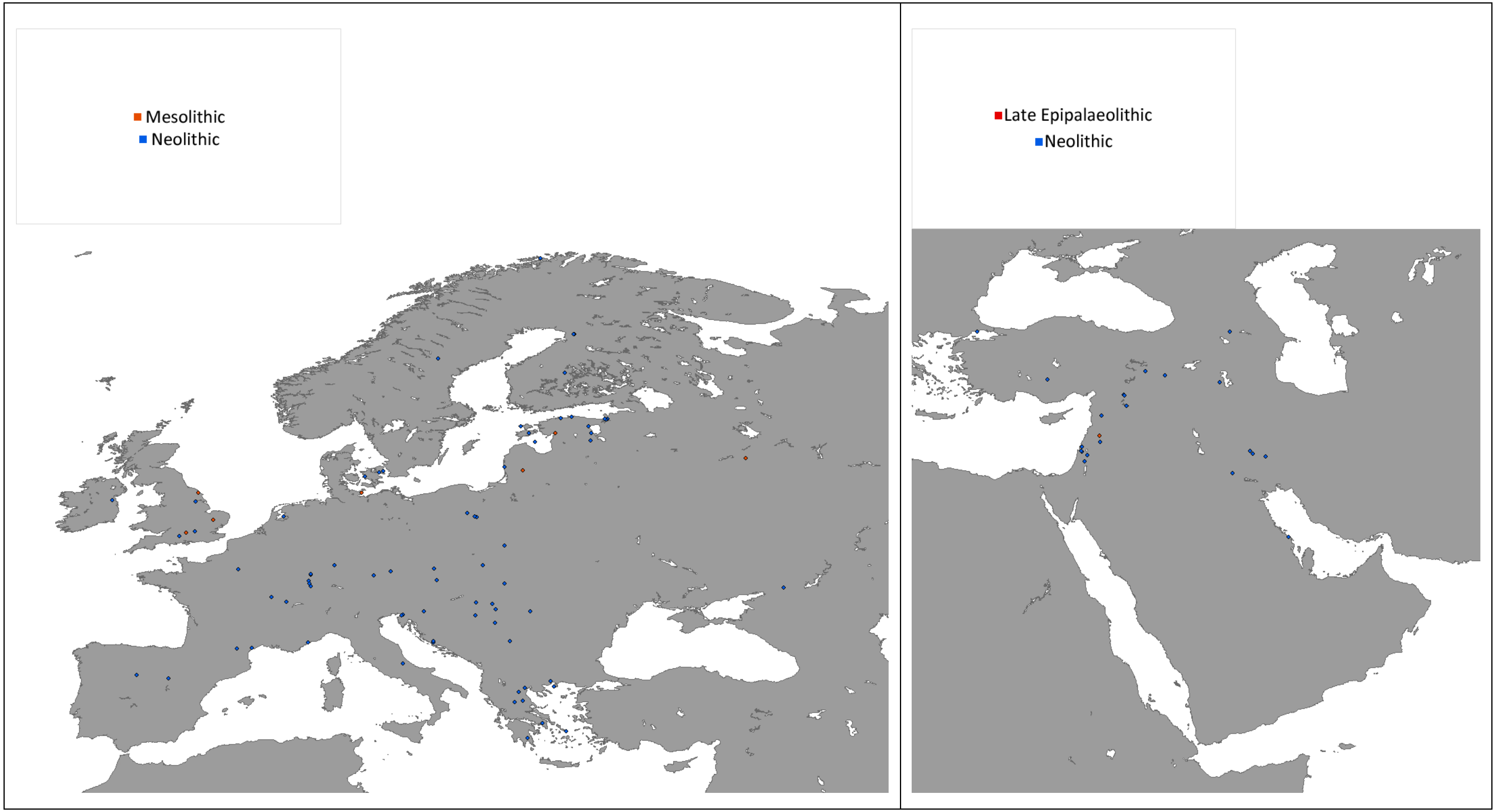


Figure 49. Distribution of unknown uses across European and Near Eastern sites.

4.7: Analysis of Adhesive Uses

A sizeable minority of application evidence has not been chemically analysed, with visual approaches being employed more frequently (Figures 50-53). Of this physical examination predominates although, as a distinct technique, chemical analysis forms a larger percentage (Figures 50 and 52). Unanalysed sites constitute the largest Neolithic percentages in both regions, whilst chemical analysis comprises the largest Mesolithic proportion (Figures 50-53). This also forms a larger percentage of European evidence relative to the Near East.

Burning evidence - entirely from the European Neolithic – has been chemically analysed without use of other analytical techniques (Figure 50). Chewing is also dominated by chemical analysis with visual approaches, mainly physical examination, contributing smaller elements (Figures 50 and 52). A significant proportion has been assessed without analysis (Figure 53). Most Mesolithic sites have been chemically analysed but a higher proportion of Neolithic sites have either been visually assessed or not analysed.

Wider ranging analysis has been applied to assess gluing evidence – with chemical analysis a minority component (Figures 50-53). Visual approaches form the majority, with physical examination predominating but less so than in other use categories (Figures 51 and 52). Analysis types vary considerably - both regionally and temporally. Most European Mesolithic and Near Eastern Neolithic evidence has been physically examined but the application of chemical analysis differs considerably (e.g., 29.5% European Mesolithic; 15.8% Near Eastern Neolithic). European Neolithic evidence is dominated by chemical analysis with less reliance on visual approaches. Late Epipalaeolithic evidence lacks any chemical analysis and is dominated by visual approaches – largely optical microscopy.

Each technique comprises roughly equal portions of manufacture analysis (Figures 50-53). European and Near Eastern approaches differ. Near Eastern evidence broadly matches the overall breakdown – with unanalysed adhesives absent from the European Mesolithic and physical examination employed to assess an isolated European Neolithic example.

Chemical analysis and combined visual approaches each contribute similar proportions of processing/production evidence although as a single technique, chemical analysis predominates (Figures 50-52). Unanalysed evidence constitutes a smaller element (Figure 53). Chemical analysis is used heavily in the European Neolithic context whilst visual analysis techniques support more European Mesolithic and Near Eastern Neolithic studies. Considerably less unanalysed evidence is attested from the European Neolithic. Late Epipalaeolithic evidence is evenly divided between chemical analysis, physical inspection and unanalysed adhesives.

Most unknown use has been chemically analysed, with other techniques forming roughly equal smaller segments (Figure 50-53). Whilst constituting most of European evidence, chemical analysis is less prevalent in the Near East, limited to the Neolithic and proportionally equivalent to physical inspection.

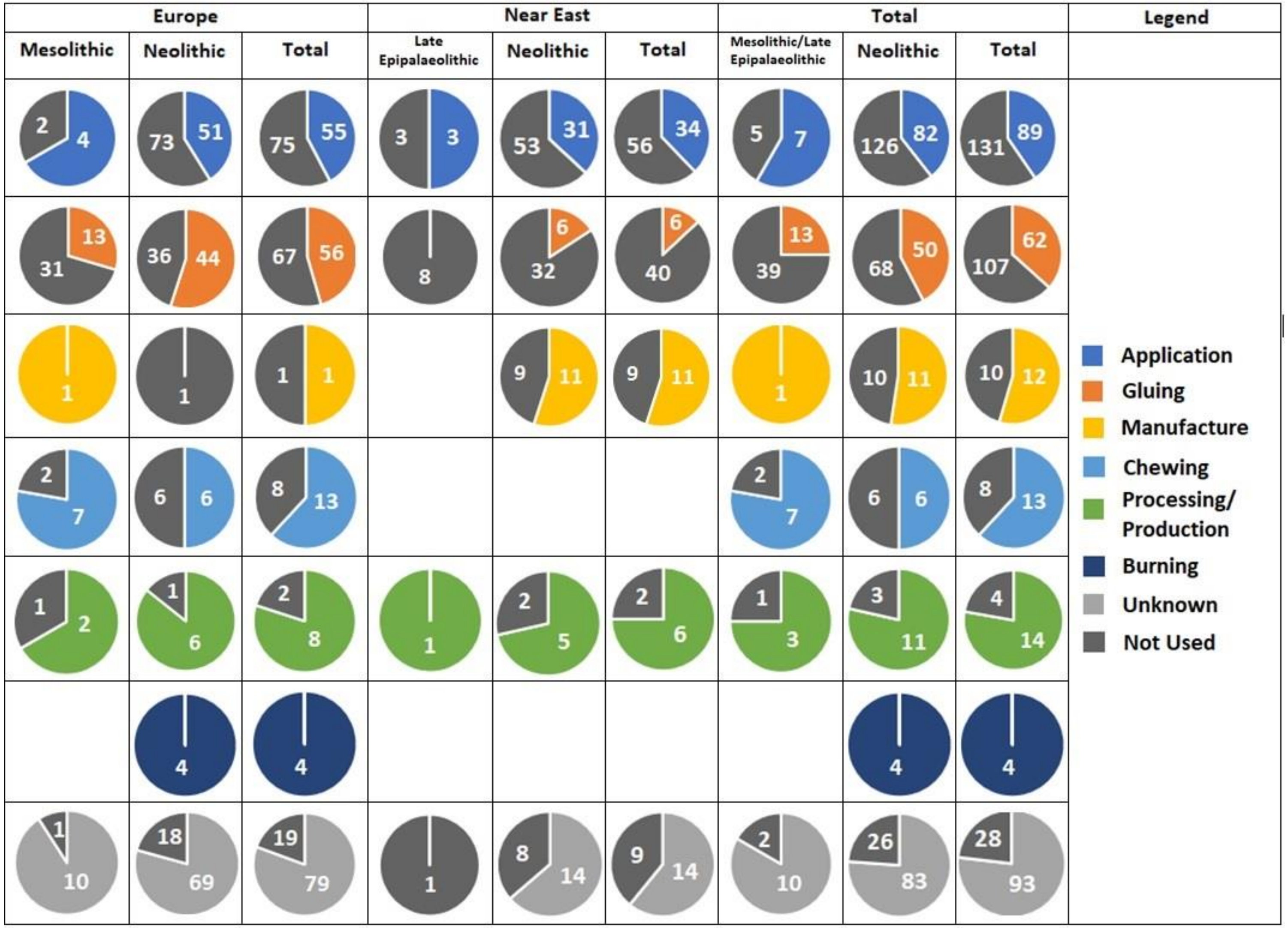


Figure 50. Use of chemical analysis by general use type, divided by region and period.

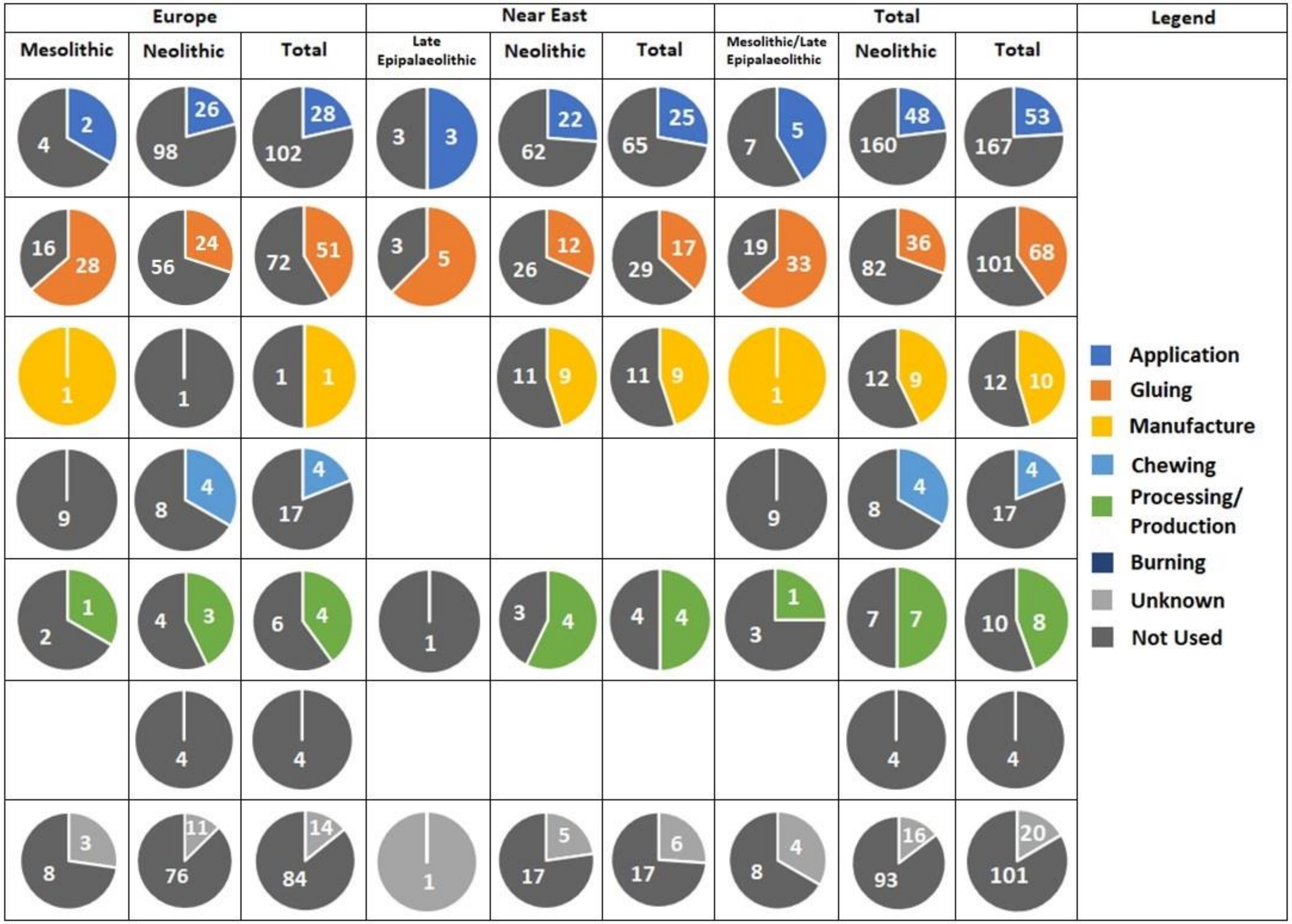


Figure 51. Use of optical microscopy by general use type, divided by region and period.

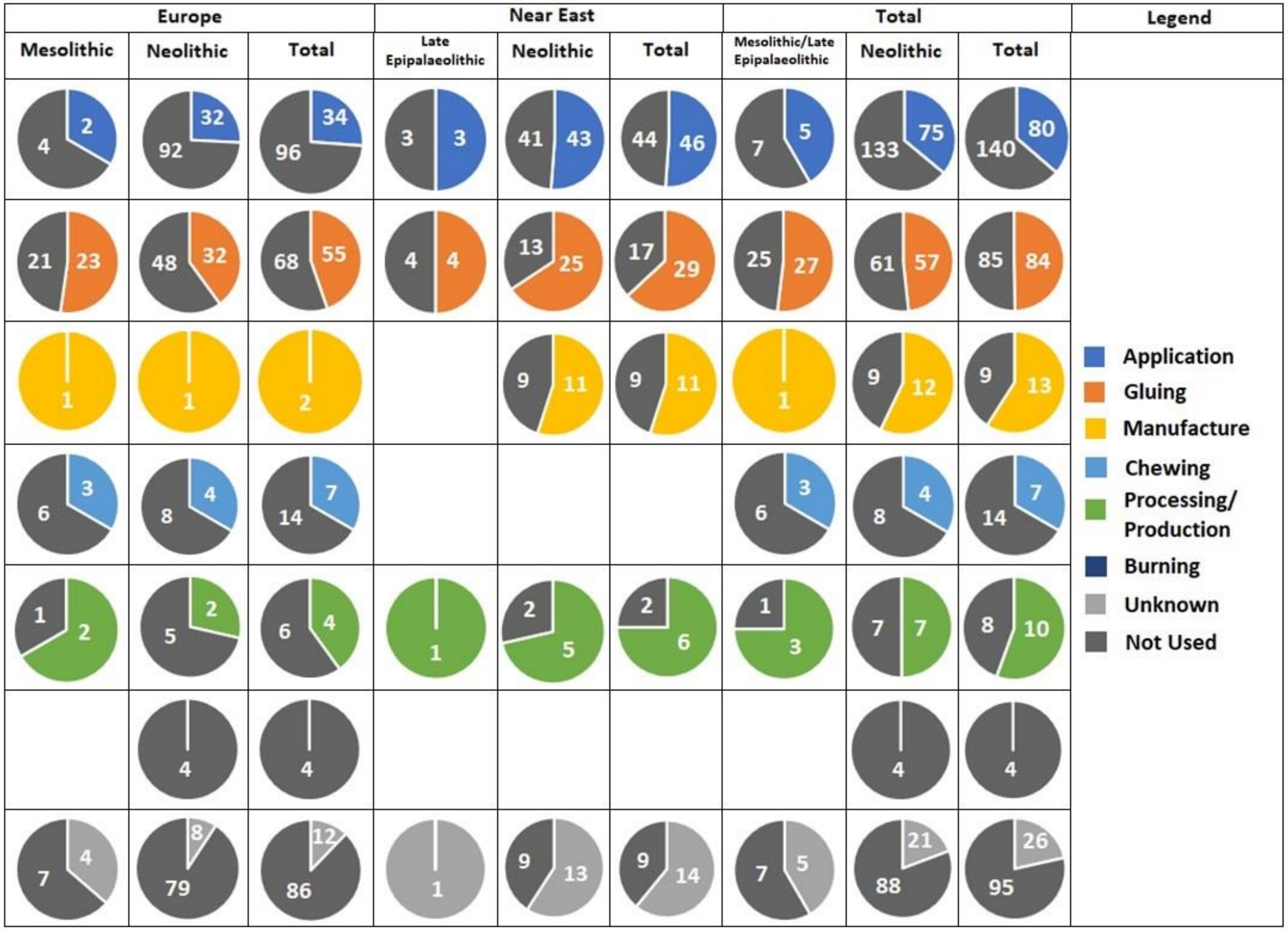


Figure 52. Use of physical examination by general use type, divided by region and period.

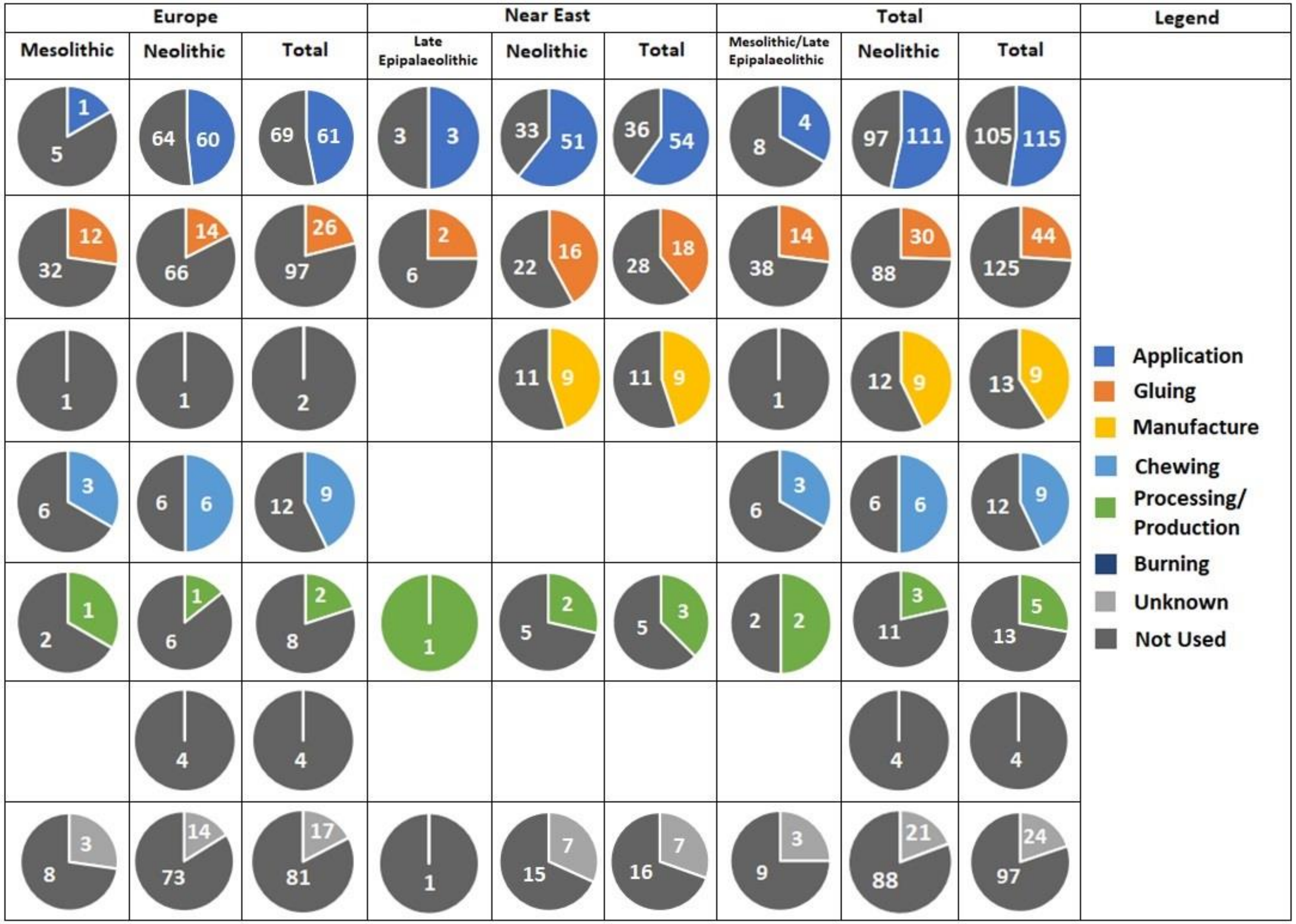


Figure 53. Use of no analysis by general use type, divided by region and period.

4.8: Adhesive Classes by Use

Most plasters have been applied to surfaces, with the remainder comprised of largely equivalent proportions of gluing, manufacture and unknown uses (all between 6-12%) (Figure 54). Processing/production evidence comprises just 2.8%. Application broadly relates to architectural roles, with manufacture linked to production of white ware (vaiselle blanche) vessels and gluing largely associated with hafting. Application forms a particularly strong component (79.8%) of European Neolithic plasters, though less prevalent on Mesolithic when compared to Late Epipalaeolithic sites. On Mesolithic sites, unknown uses form the dominant use category with manufacture a significant minority of Near Eastern Neolithic evidence. Most plaster sub-types have been applied to surfaces - certain varieties (chalk, clay, dung, mud, loam, marl and unidentified) are almost entirely dominated by application (70%+) but this is slightly less prominent for gypsum and lime which attest greater manufacture and processing/production use (Figure 61). Little regional or temporal variation is present overall, although unidentified plasters are more heavily utilised in gluing and manufacture in Near Eastern contexts compared to the European Neolithic, which makes greater use of application.

A greater array of purposes has been interpreted for tars, with gluing predominating, followed by application, unknown uses and chewing as significant categories (Figure 55). Gluing and chewing comprise most Mesolithic evidence, with application (mainly container/object decoration) and unknown uses significant for Neolithic tars although gluing still predominates. Chewing declines significantly between the Mesolithic and Neolithic. Whilst birch bark tar largely matches the overall tar use distribution – apart from a slight increase in chewing in the European Mesolithic – pine bark and beech/oak tars are dominated by application and unknown uses (Figure 62).

Most beeswax has not been attributed any general uses, falling into the unknown category (Figure 56). Some have been suggested as having roles in flavouring, processing or storage but the vast majority remains unidentified, detected largely through chemical analysis (see above) of ceramic sherds often lacking clear signs of utilisation. All Near Eastern Neolithic and nearly 80% of European Neolithic beeswax falls under the unknown category. European Mesolithic evidence is more diverse - with gluing the largest component in the context of use as a plasticiser in hafting lithics. Application is the largest part of the remainder overall derived largely from interpretation of sealing/waterproofing containers.

Bitumen has more diverse uses (Figure 57) – gluing forms just half of the total, with application a significant secondary category representing use in container and object decoration (such as ceramics and PPNB plaster statues). Whilst most Late Epipalaeolithic and European evidence consists of gluing, Near Eastern Neolithic evidence is more diverse. Application uses approach gluing in relative proportion with manufacture, processing/production and unknown uses also attested.

Unknown uses form the largest segment of resin classes, with application and gluing forming roughly equal portions of the remainder (Figure 58). Use varies considerably by period – with more gluing in Late Epipalaeolithic/Mesolithic contexts whereas application and unknown uses combined dominate the Neolithic – as well as sub-classes (Figure 63). Most pine resin is assigned an unknown use with gluing less widely attributed than resins overall. Conifer resins are relatively evenly divided between gluing (37.5%), application/unknown uses (25% each) and burning (12.5%). Unidentified resins show similar variety – however gluing is the most significant component, with application at 26.3% in line with the class and chewing/unknown each comprising between 10-16%. Application is however the largest segment of European Mesolithic and unknown use 100% of Near Eastern Neolithic evidence. Cupressaceae, fir and Pistacia resins all follow a similar trend with 50% having unknown uses (although in the case of Pistacia resin, this encompasses preservative use to resinate wine). Outside this, Cupressaceae resin use is evenly assigned to application and burning; Pistacia resins wholly to application (sealing/waterproofing) and fir to gluing. A single Mesolithic example of propolis resin is interpreted as having unknown medicinal uses. Algin and styrax resin appear entirely utilised in application, with algin used as a surface pigment binder in Europe and styrax resin applied to a human skull at a Near Eastern site – both in the Neolithic. Fruit gum is assigned a use in gluing in Mesolithic Europe.

Gluing also constitutes the overwhelming majority of unidentified adhesives with little regional or temporal difference – although more application use is attested for Near Eastern Neolithic evidence reducing the relative gluing percentage (Figure 59). Nearly all gluing evidence for unidentified adhesives pertains to hafting.

Animal glues are split between application (63.7%) and gluing (33.3%) (Figure 60). Gluing constitutes all European Mesolithic evidence whilst application dominates the European Neolithic. The two categories are equivalent in the Near Eastern Neolithic. Egg glues all appear as pigment binders applied for painting surfaces, whereas unidentified and most collagen glues were used in gluing (Figure 64). One collagen example in the Near Eastern Neolithic had an application use sealing or waterproofing baskets.

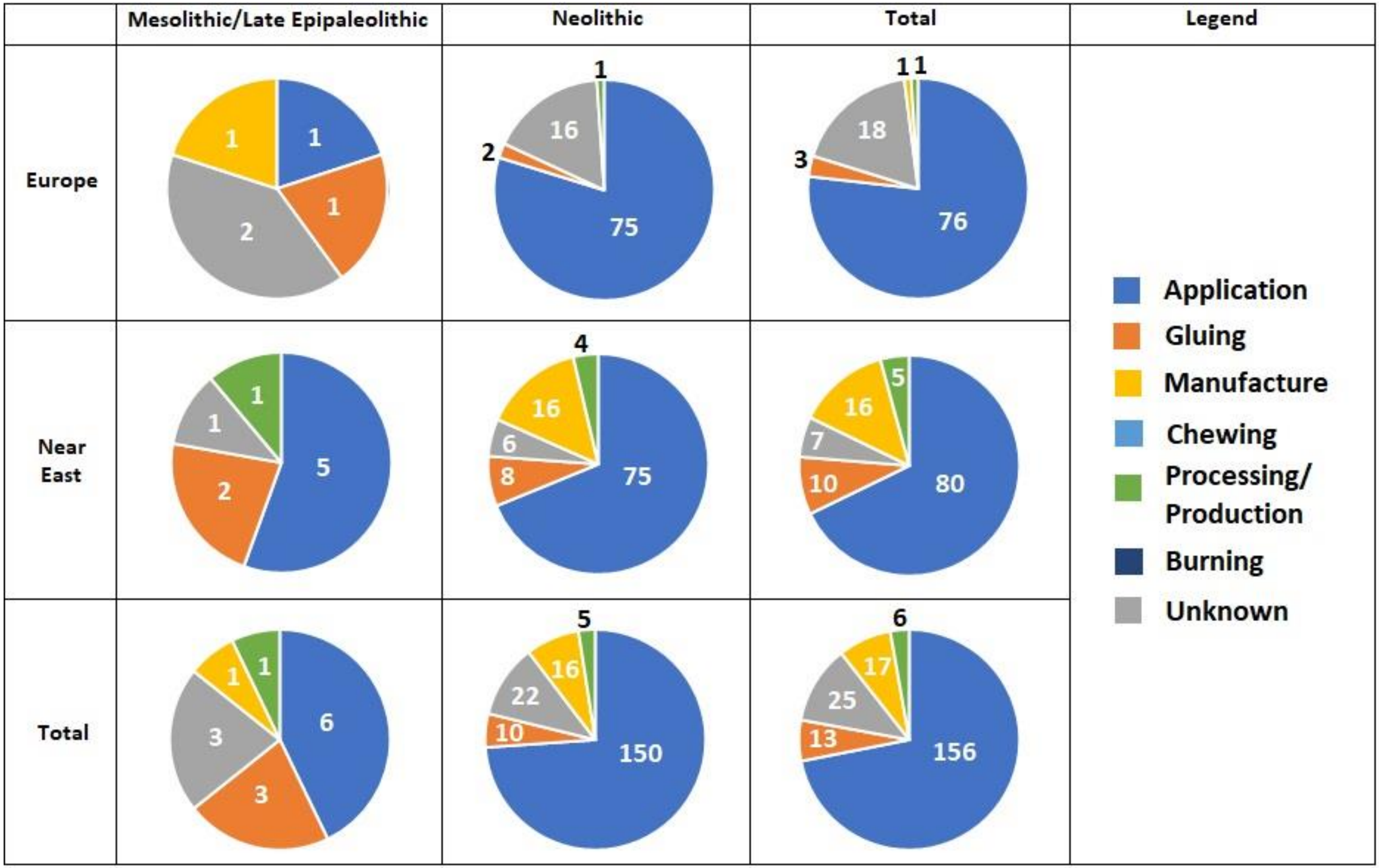


Figure 54. General usage of plasters, by region and period.

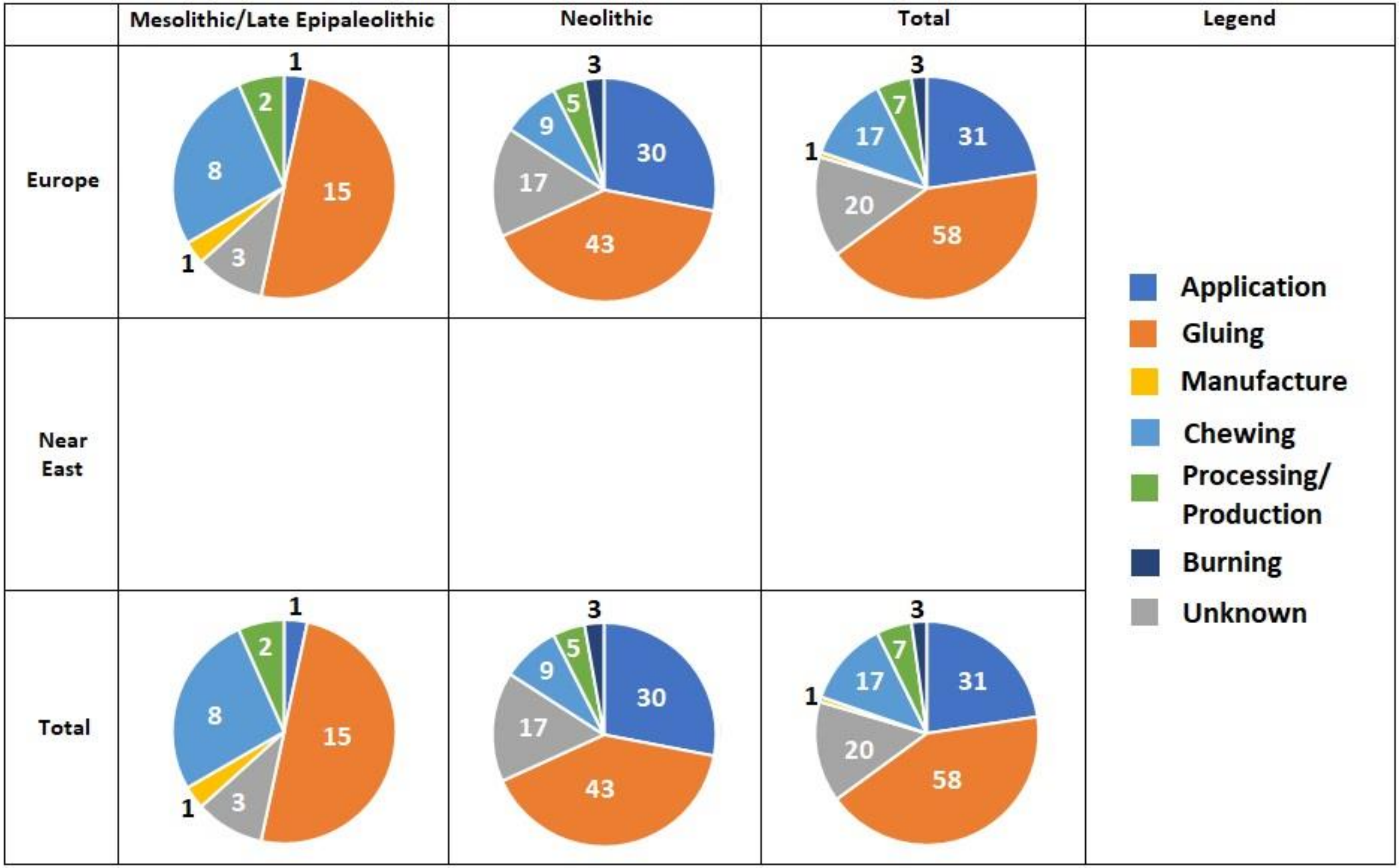


Figure 55. General usage of tars, by region and period.

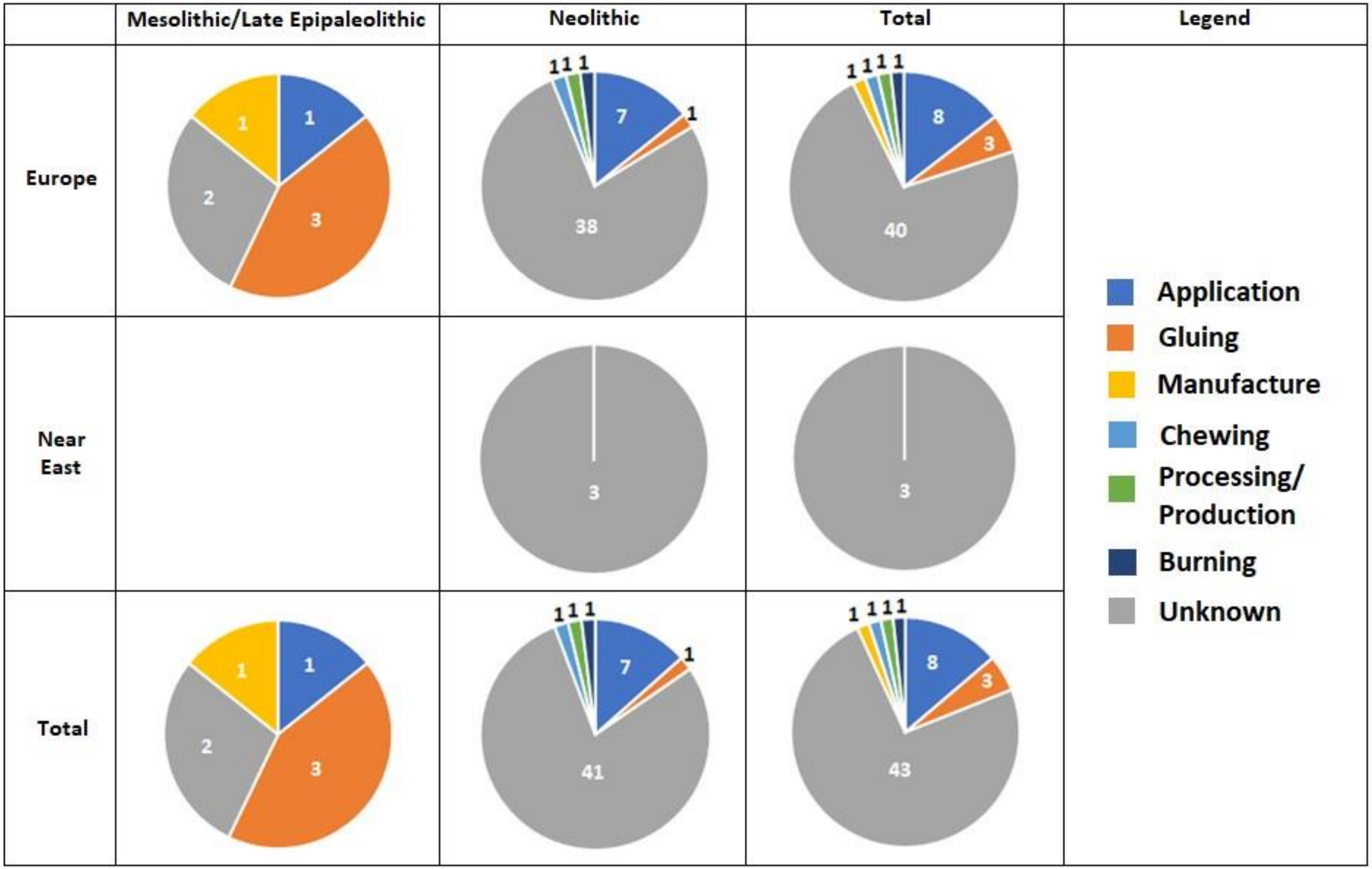


Figure 56. General usage of beeswax, by region and period.

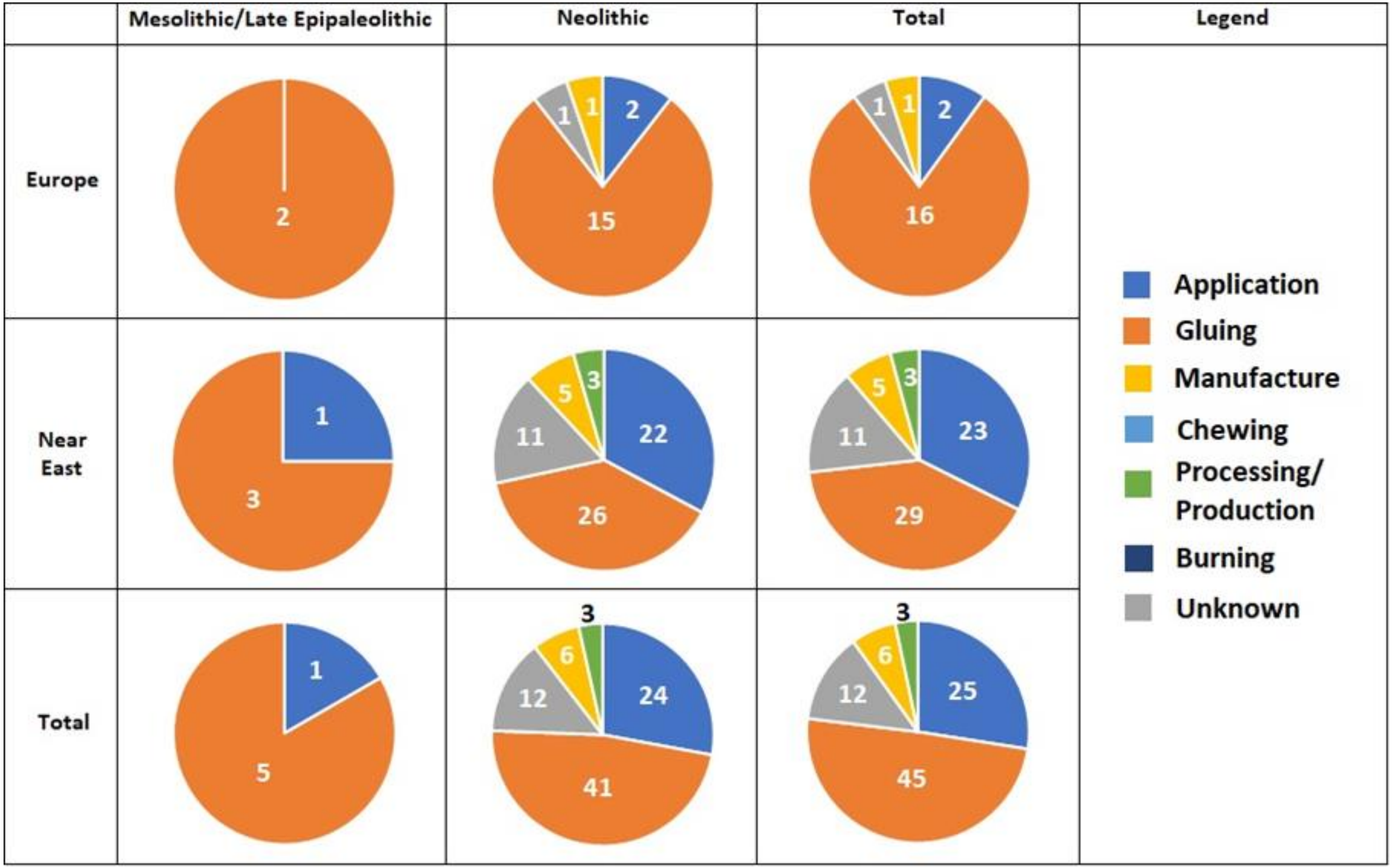


Figure 57. General usage of bitumen, by region and period.

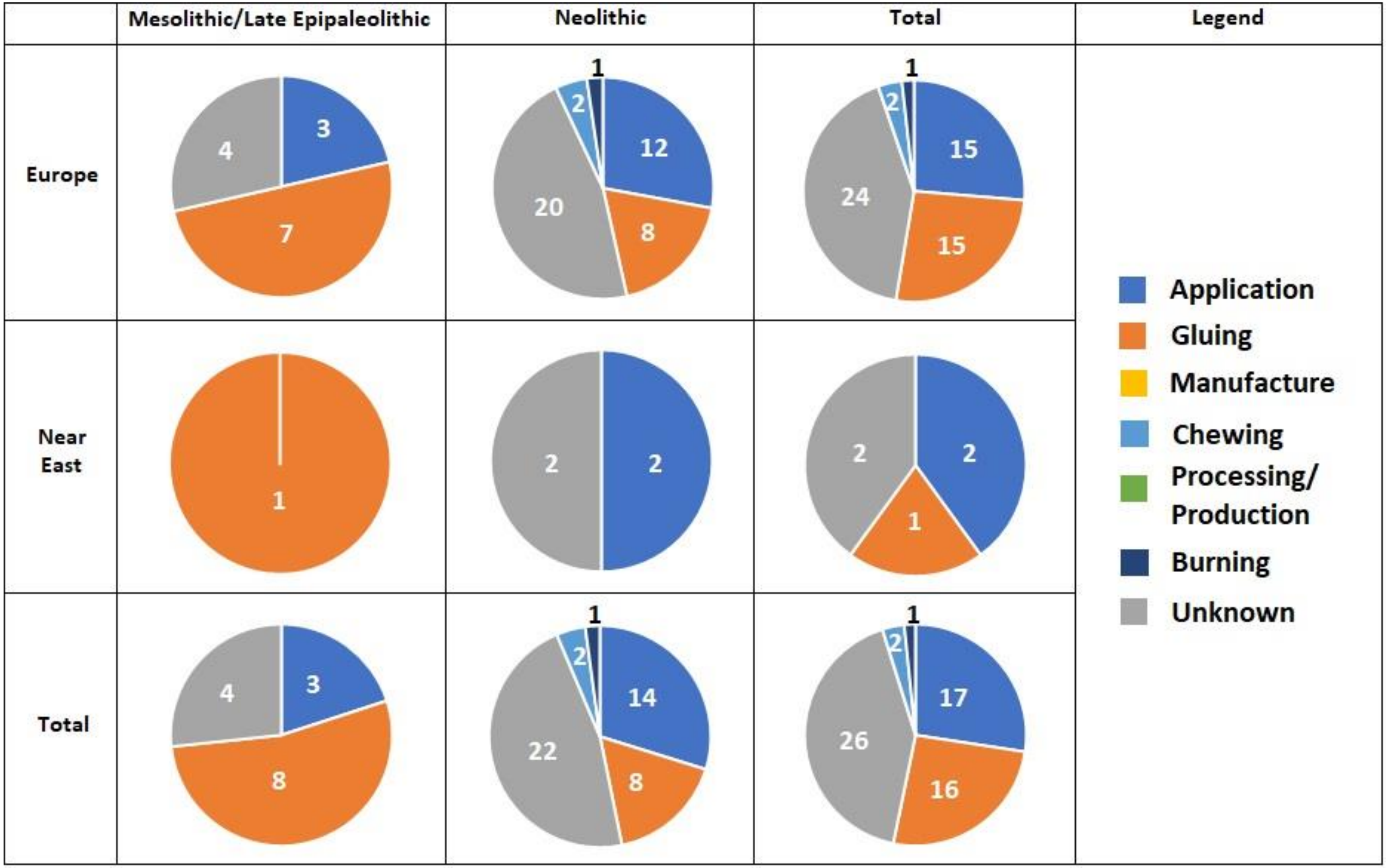


Figure 58. General usage of resins/other, by region and period.

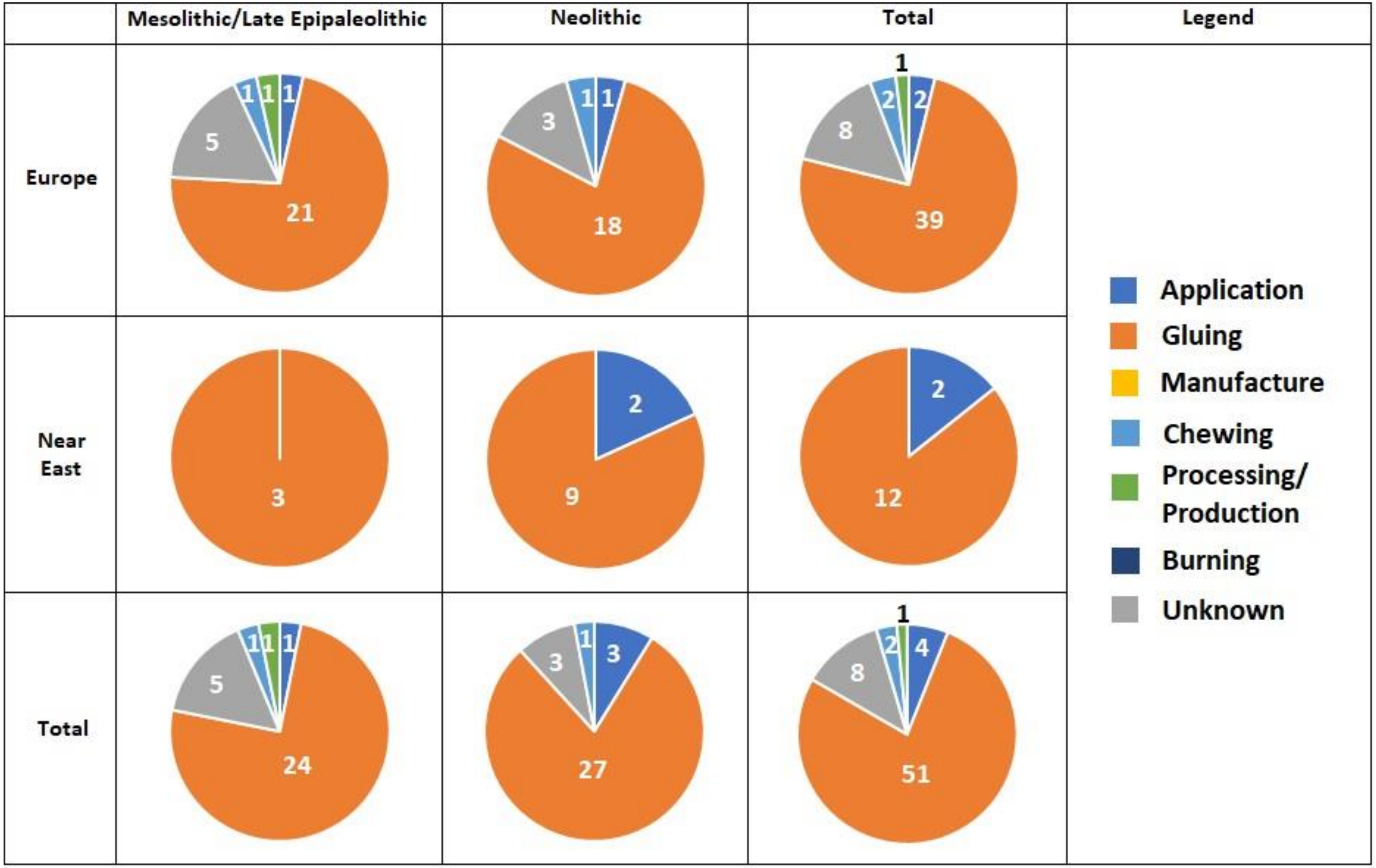


Figure 59. General usage of unidentified adhesives, by region and period.

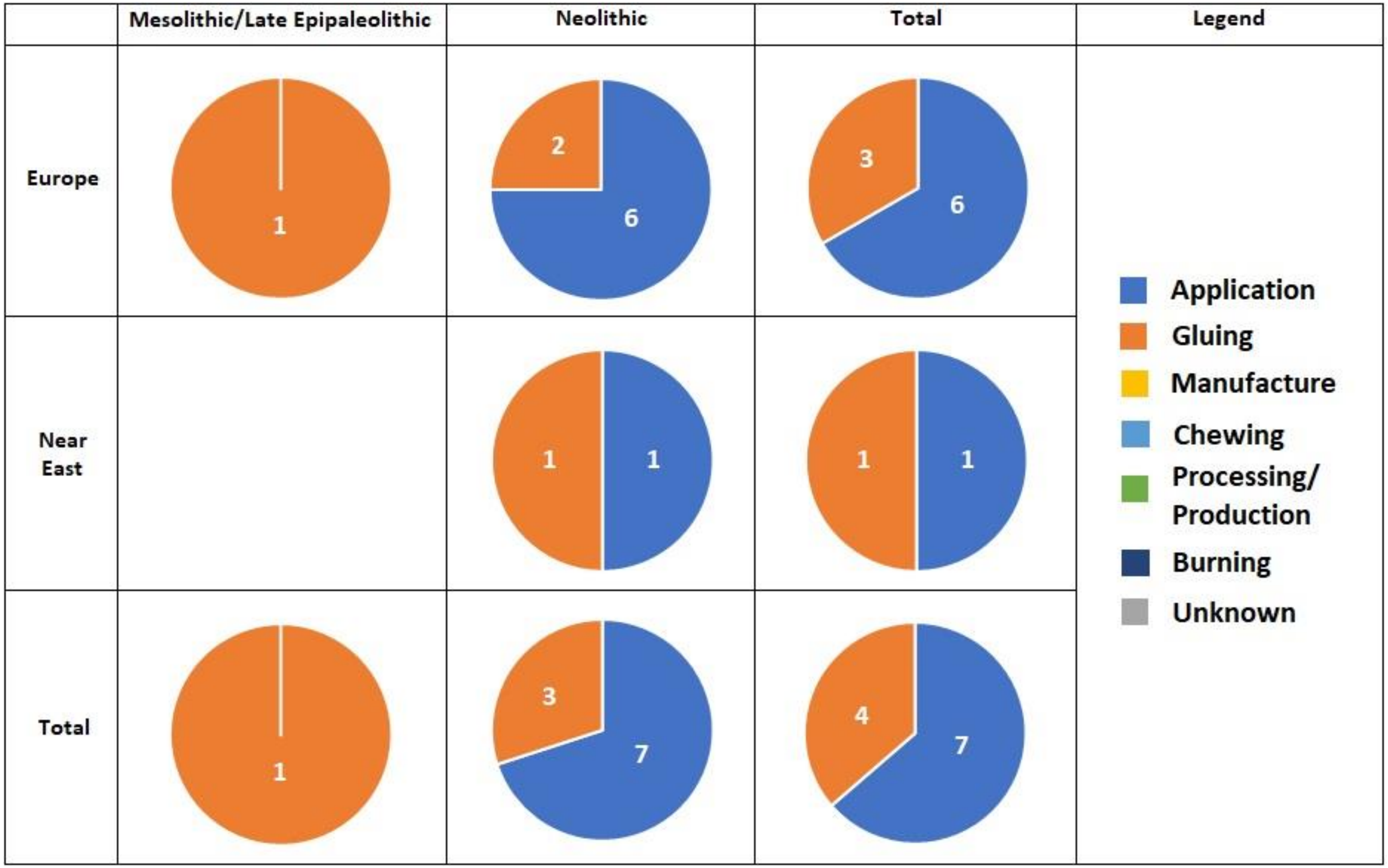


Figure 60. General usage of animal glues, by region and period.

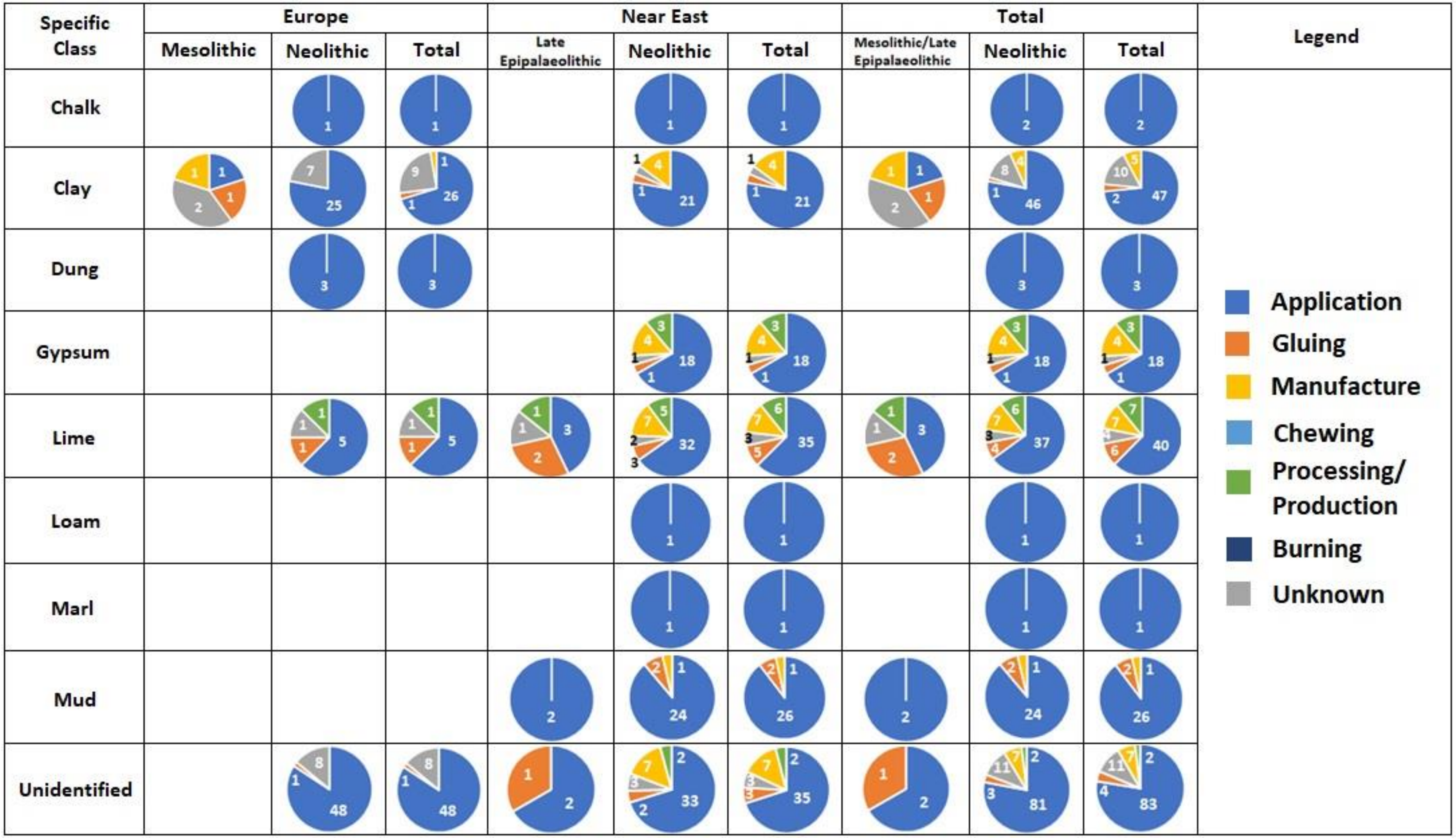


Figure 61. General use indications by specific plaster class, divided by region and period.

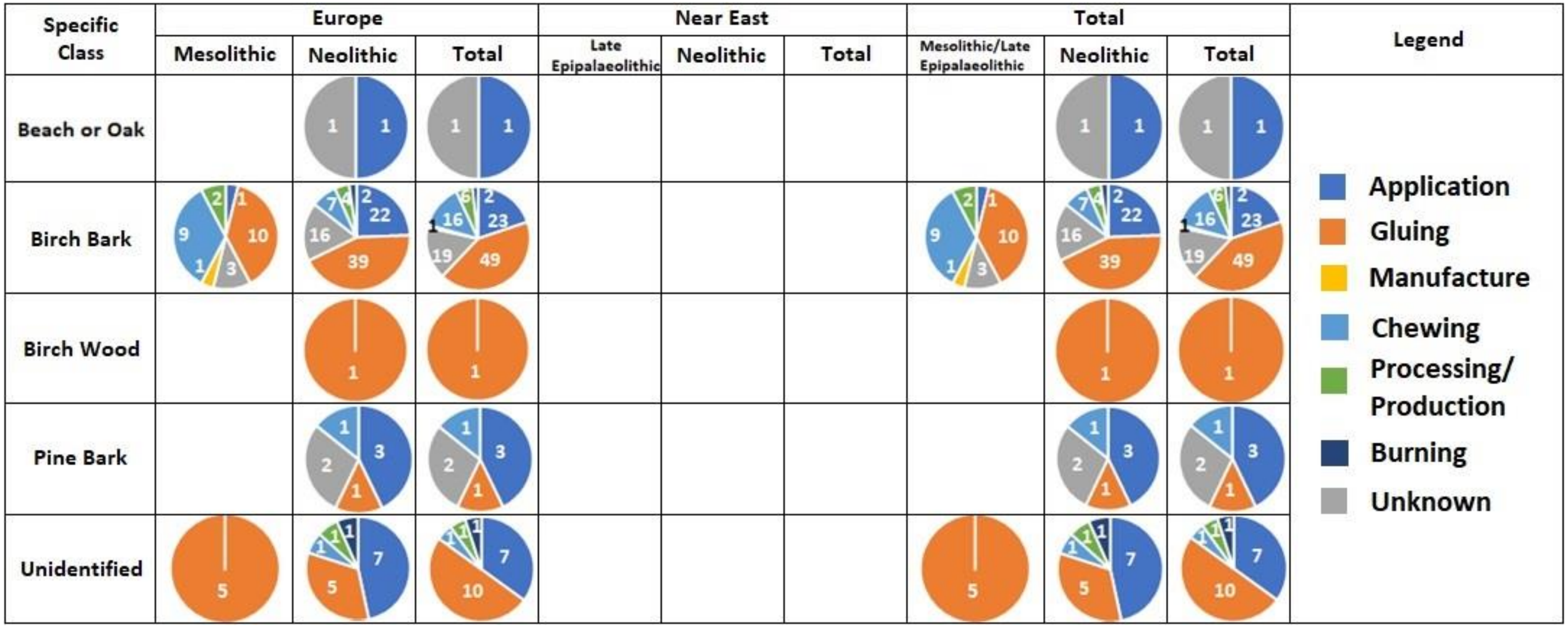


Figure 62. General use indications by specific tar class, divided by region and period.

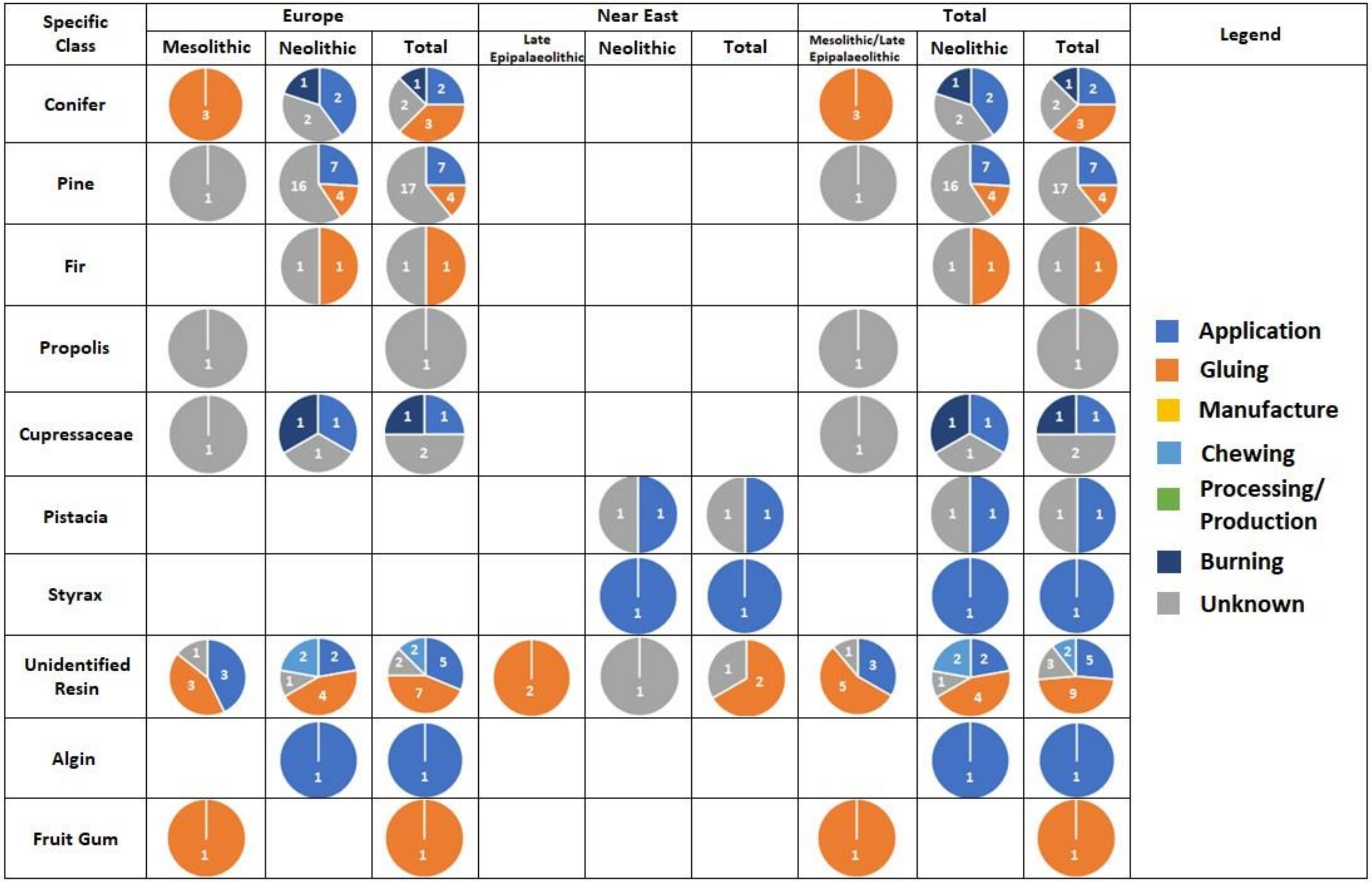


Figure 63. General use indications by specific resin/other class, divided by region and period.

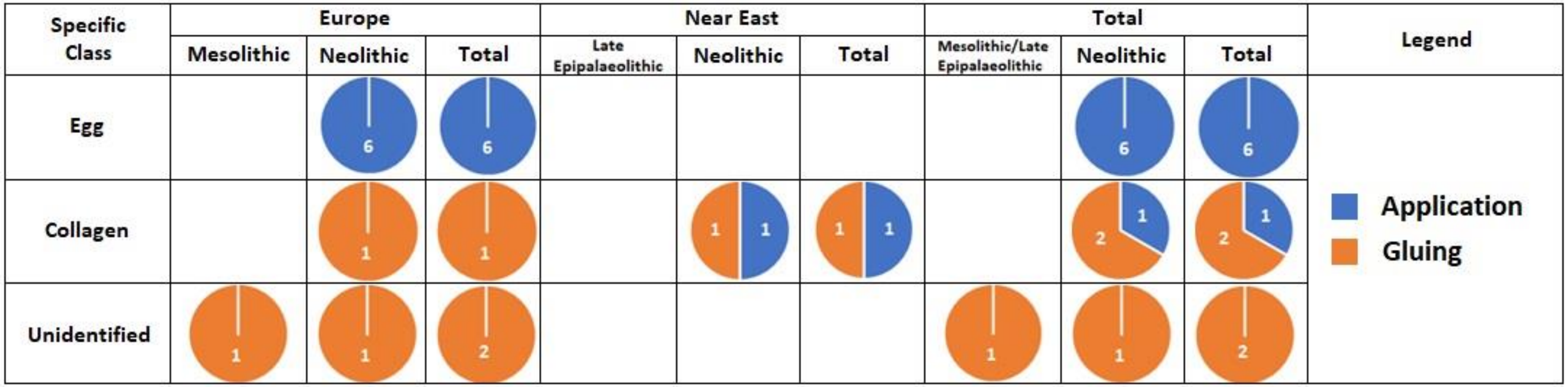


Figure 64. General use indications by specific animal glue class, divided by region and period.

4.9: Overview of Additives

Additives occur at a minority of sites overall – with aggregates occurring more frequently than plasticisers and other elements (Figure 65). With the exception of plasticisers, which occur more frequently at European sites, additives form a higher percentage of Near Eastern evidence with little temporal difference attested. There is a potential for some or many aggregates to represent accidental inclusions, especially in plasters which may have naturally contained some degree of mineral content within soils/rocks. Furthermore, some substances classified as plasticisers may not represent plasticiser use at all – e.g., animal fats mixed with beeswax residues.

The vast majority of additives occur alone, with little variation in the frequency of multiple additives between periods or regions (Figure 66). Although additive types form a greater percentage of Late Epipalaeolithic/Mesolithic data, this can be attributed to the lower number of sites for these periods, the overall number of examples remaining similar to Neolithic evidence. More frequent use is made of multiple aggregates, with the Near Eastern Neolithic seeing an even split between isolated and multiple aggregates. Higher numbers of aggregates occurring in the same adhesive are attested – whereas plasticisers/other elements see no more than two within the same adhesive, up to 5 aggregates can be attested within a single adhesive.

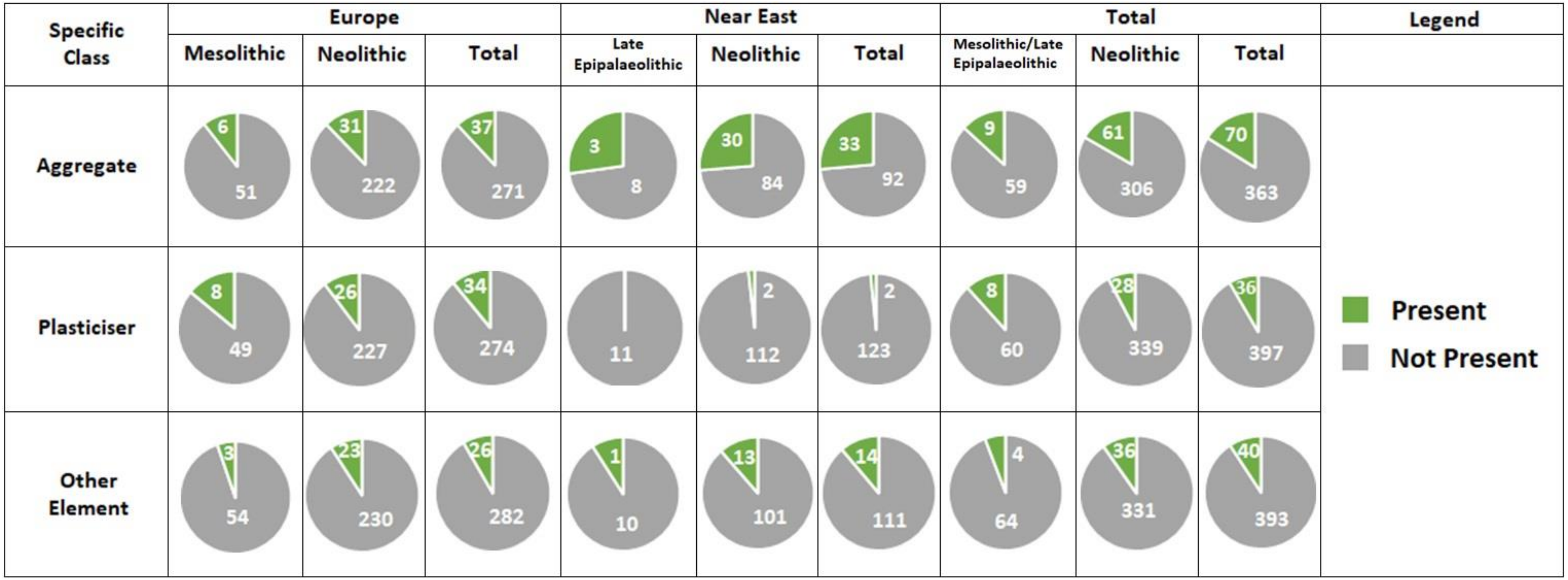


Figure 65. Sites attesting aggregates, plasticisers or other elements, by region and period.

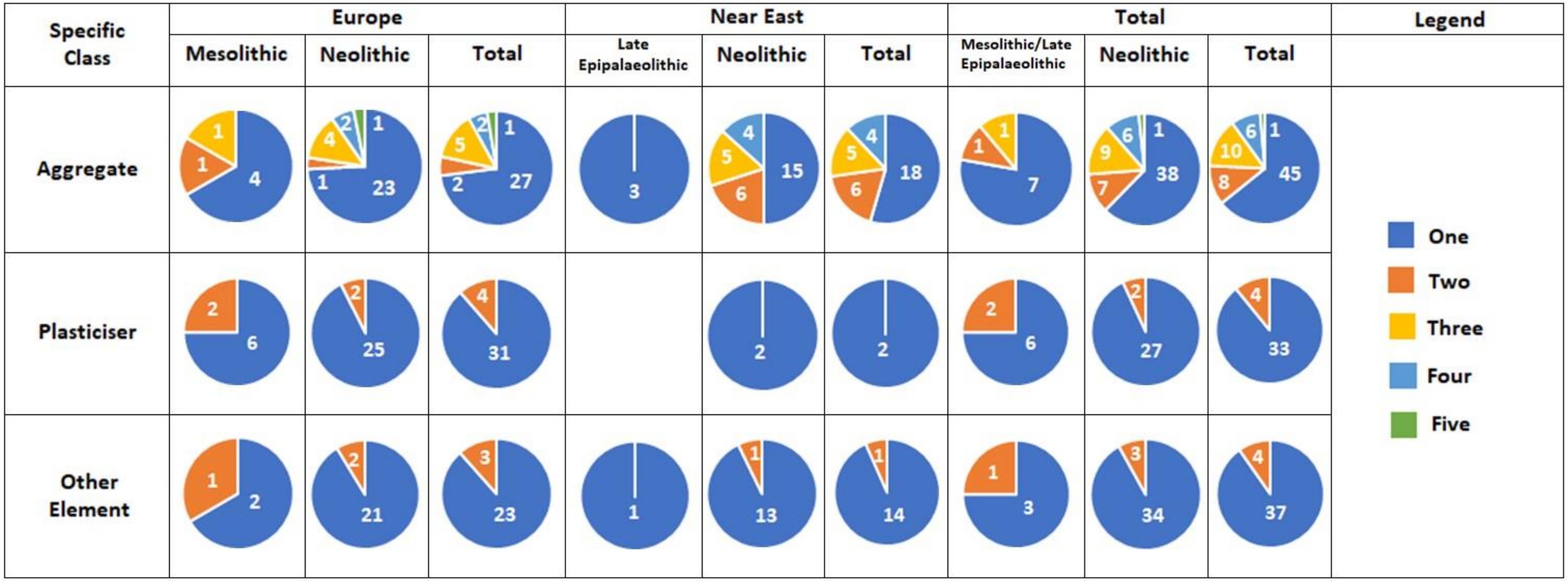


Figure 66. Maximum number of aggregates, plasticisers or other elements used in one adhesive in attesting sites, by region and period.

4.10: Aggregates

Aggregates derive from a minority of sites and while they do not significantly differ temporally, they do quite considerably regionally. A wide array of types is attested (Figure 67) – with vegetal material forming the largest single category and quartz, sand, calcite, charcoal, ochre and limestone each forming significant percentages (5-11%). 6.8% is unidentified with the remaining 28.7% comprising 19 separate materials, each attested by a handful of examples. Aggregates differ considerably by period and region – in the Near East vegetal material, calcite and quartz form the largest components in Neolithic aggregates, while Late Epipalaeolithic aggregates are split evenly across ash, ochre and soil. European aggregates are less diverse – with charcoal a large minority of Mesolithic aggregates and vegetal material, sand, unidentified and quartz combined forming over 50% of Neolithic evidence. European Neolithic aggregates also utilise a wider range of aggregates compared to the preceding Mesolithic.

Plasters comprise by far the majority adhesive with aggregate elements (Figure 68), with the remainder comprised of equivalent proportions (6-11% each) of tars, resins, bitumen and unidentified adhesives. Animal glues form just 1.4%. Resins, however, form the majority of European Mesolithic evidence, followed by unidentified adhesives. Likewise, a significant secondary percentage of European Neolithic aggregates derives from tars. Use varies more by period than region (Figure 69), with the majority of European Mesolithic and Late Epipalaeolithic aggregates involved in gluing compared with the Neolithic, where application dominates both regions, although a significant category of Near Eastern Neolithic evidence is attributed to manufacture.

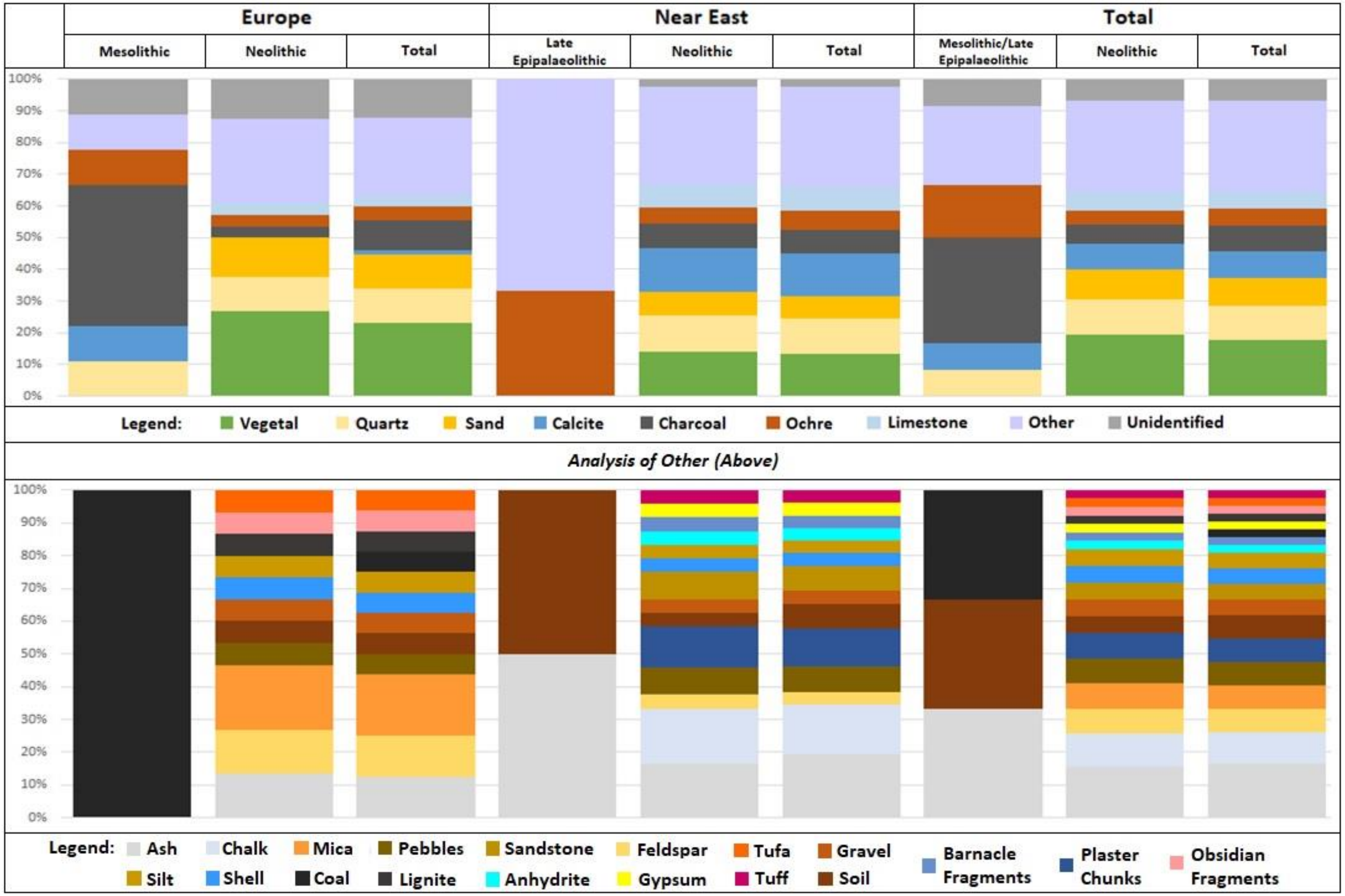


Figure 67. Types of aggregate, by region and period.

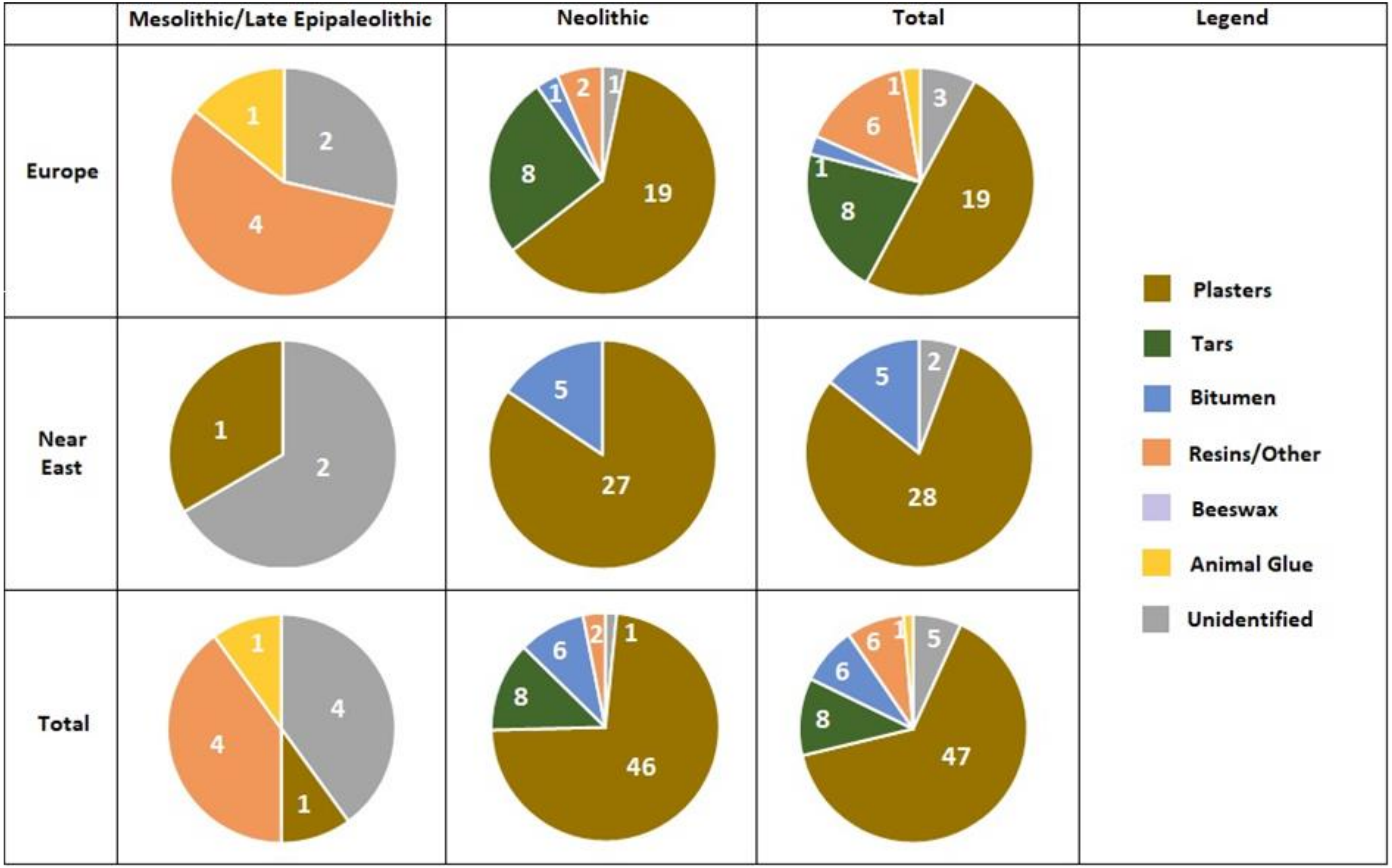


Figure 68. Aggregate use by general adhesive class, by region and period.

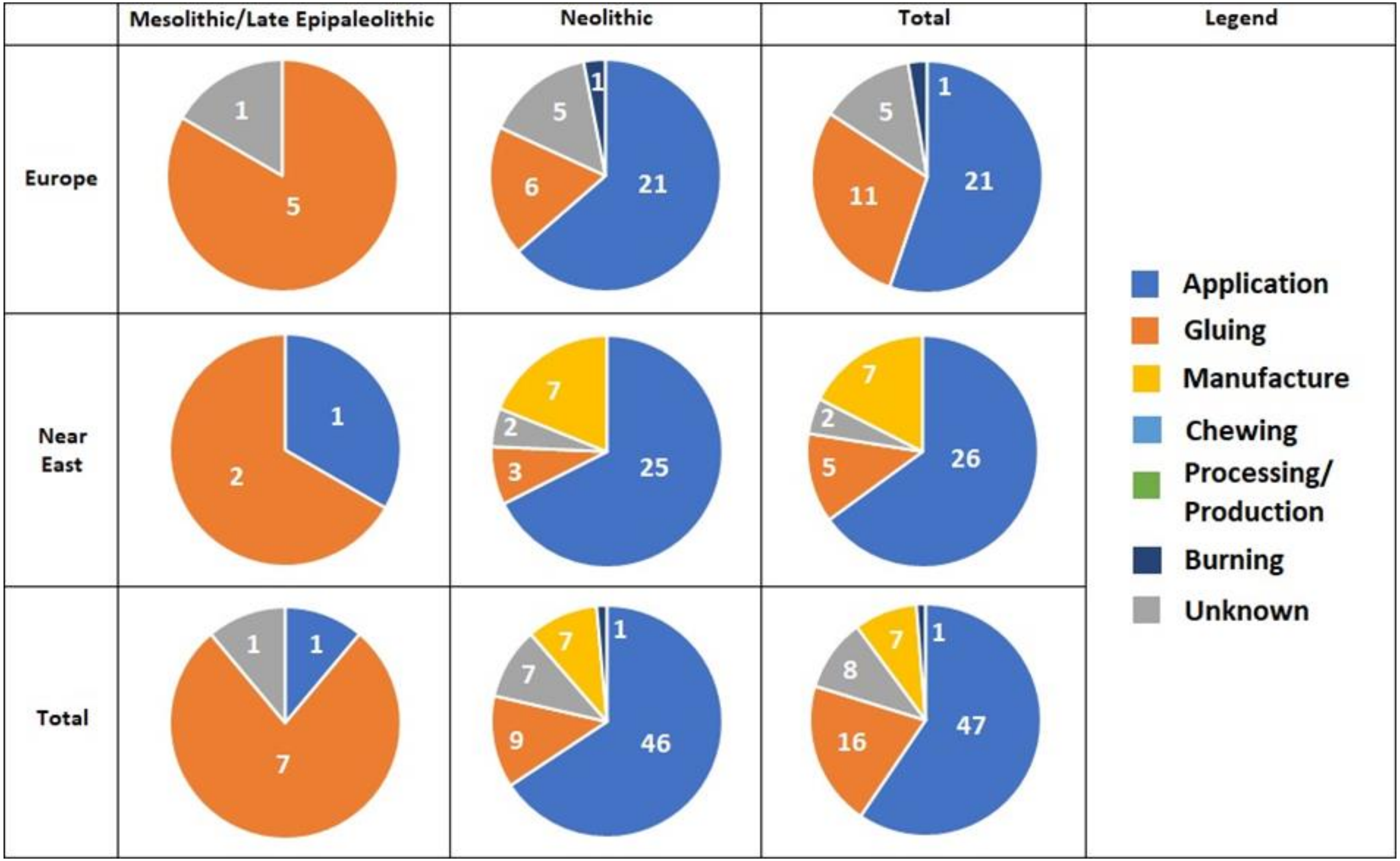


Figure 69. Aggregate use by general use type, by region and period.

4.11: Plasticisers

A smaller range of substances have been identified with plasticiser use. They are associated with fewer sites than aggregates – deriving almost entirely from Europe. Little temporal difference is exhibited. Animal fats form the majority component, with beeswax and clay smaller percentages (Figure 70). European Neolithic evidence consists overwhelmingly of animal fats, with Mesolithic plasticisers more evenly divided. Just two examples exist from the Near Eastern Neolithic – evenly divided between animal fat and clays.

Plasticisers exhibit more diverse uses than aggregates in a wider range of adhesives. Figure 71 demonstrates tars comprise the largest group containing plasticisers, with resins and beeswax forming similarly sized proportions of the remainder. These dominate the European Neolithic, whilst the Mesolithic shows greater diversity. Near Eastern Neolithic evidence splits evenly between beeswax and bitumen. Most adhesives containing plasticisers have been employed for unknown uses, with gluing and application also forming significant percentages (Figure 72). Unknown uses form the largest segment of European and Near Eastern Neolithic evidence, with application making up the remainder of Near Eastern Neolithic and application/gluing comprising similar percentages of the remaining European Neolithic evidence. European Mesolithic evidence consists mostly of gluing with the rest comprised of unknown uses.

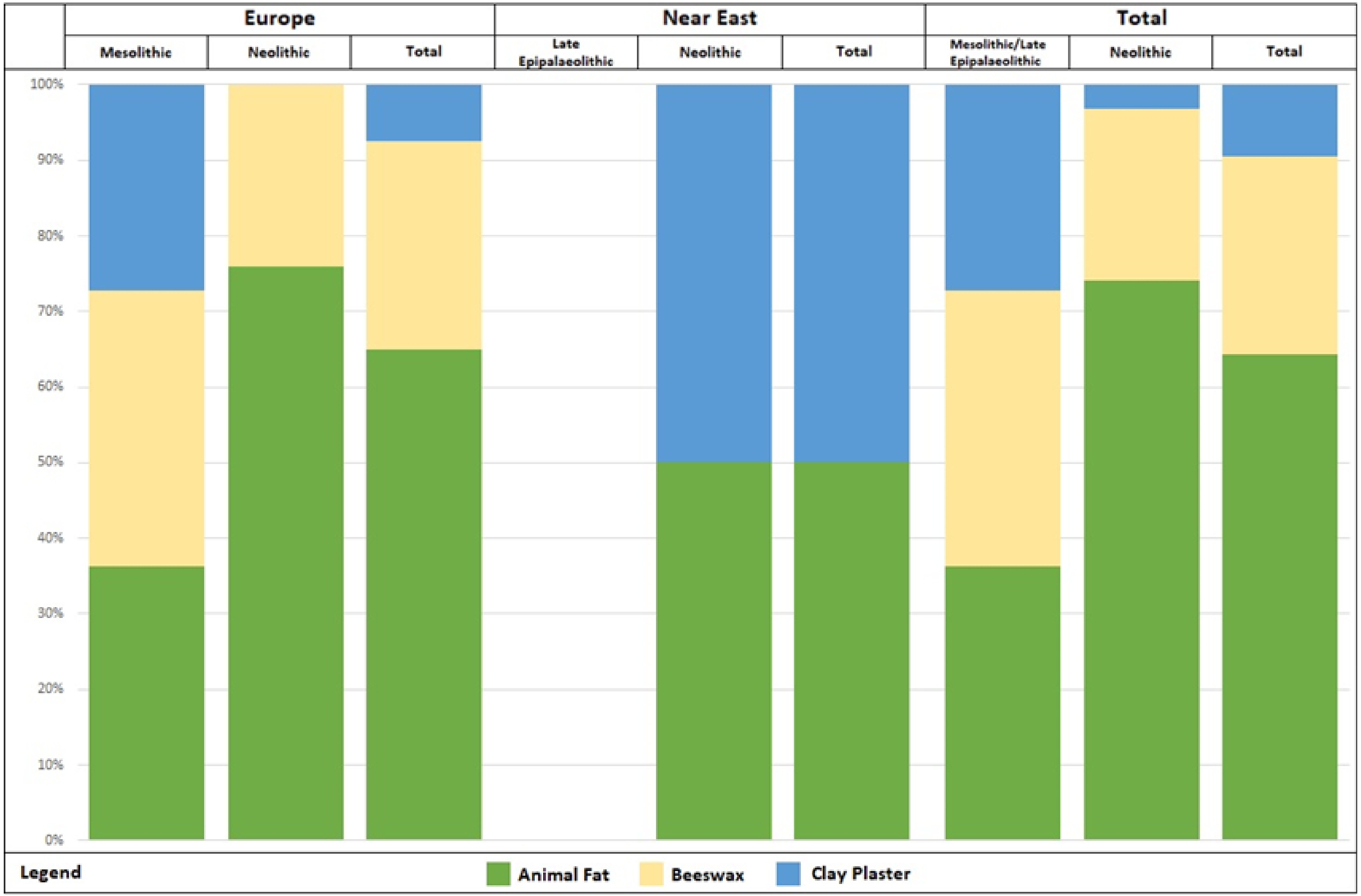


Figure 70. Types of plasticiser, by region and period.

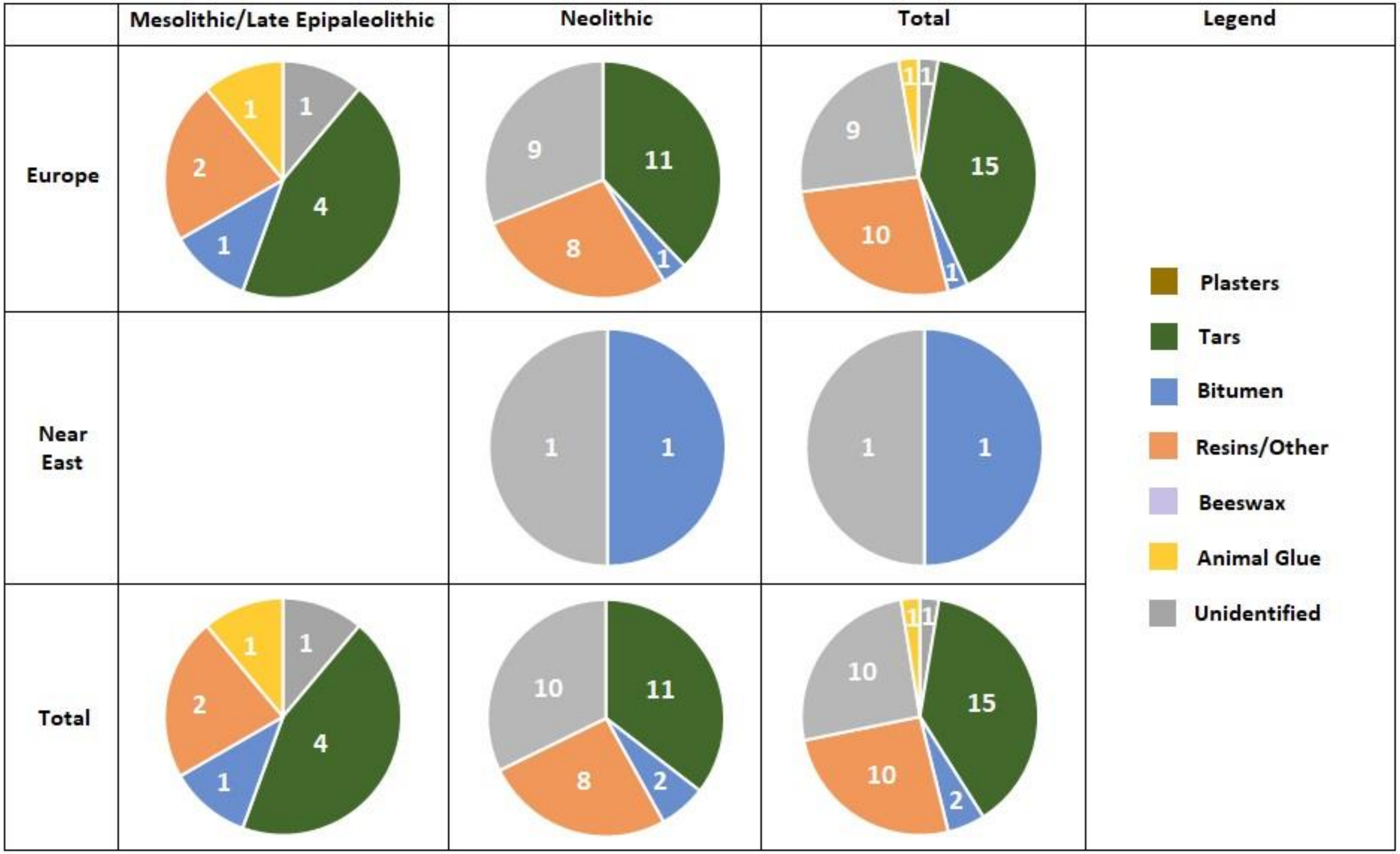


Figure 71. Plasticiser use by general adhesive class, by region and period.

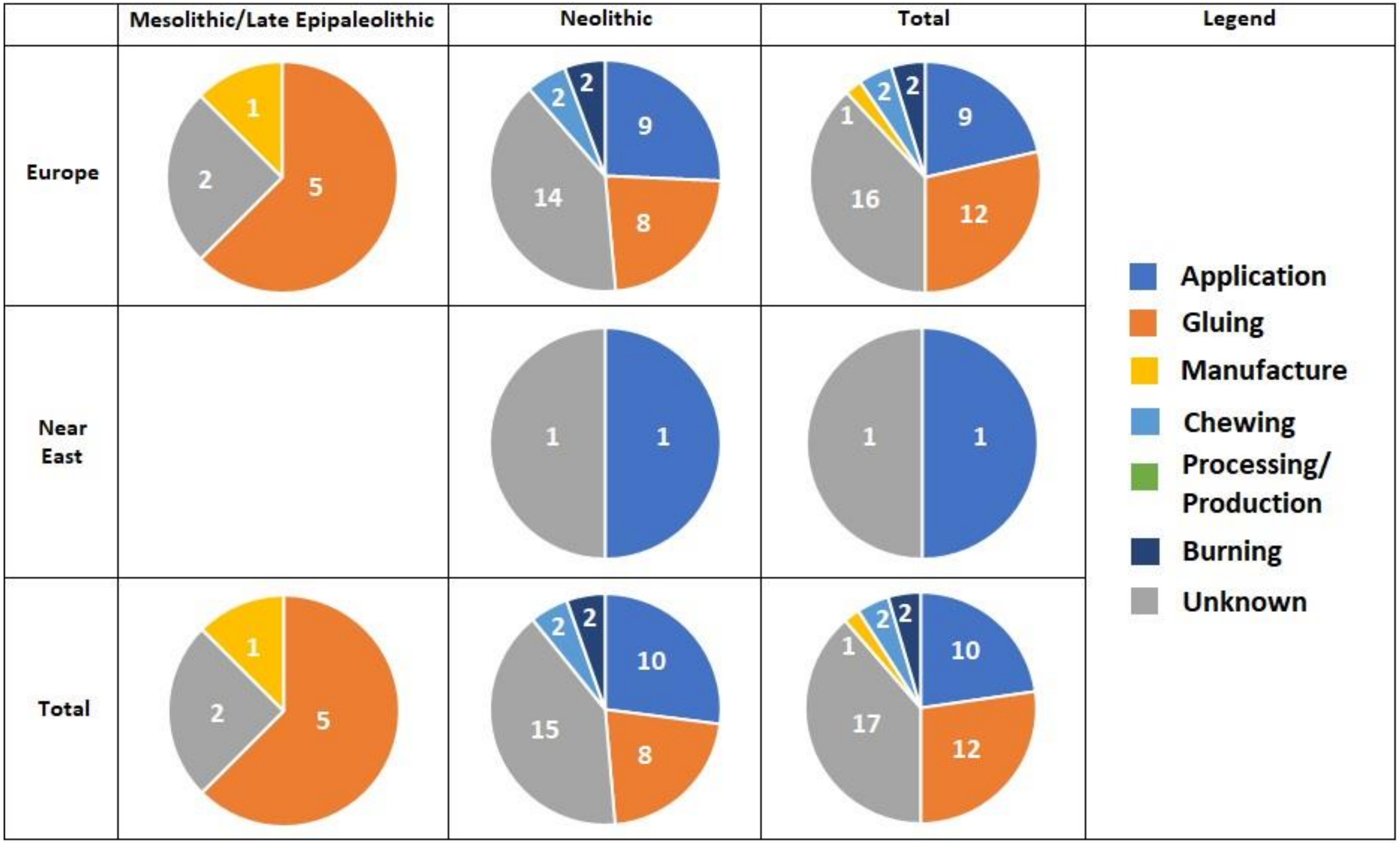


Figure 72. Plasticiser use by general use type, by region and period.

4.12: Other Elements

Other elements feature in a small percentage of sites, remaining fairly constant across periods and regions. As determining the role of added elements proved difficult for some substances (plant oils, other plasters, etc), this category may contain some plasticiser evidence not explicitly highlighted. Dairy products, plant oils and clay and lime plasters jointly constitute the largest individual percentages (12-14% each) with the remaining 16 identified types each consisting of a handful of examples (Figure 73). Late Epipalaeolithic/Mesolithic elements are less diverse than the Neolithic – with European Mesolithic evidence evenly divided into four elements and the Late Epipalaeolithic consisting entirely of lime plaster. Neolithic sites attest wider ranges of elements. The four main types combined account for the majority of evidence from the Neolithic in both regions.

By adhesive class, plasters comprise the largest segment of other uses, but not a majority (Figure 74). Beeswax and resins each form similar-sized secondary segments. This differs considerably both regionally and temporally – Near Eastern evidence almost exclusively consists of plasters. European evidence is considerably more diverse – with resins forming the majority in the Mesolithic and beeswax the largest component of Neolithic data. Resins, tars and plasters constitute 12-25% of the remaining total. Uses follow a similar pattern to adhesives generally – application predominates overall with unknown uses a substantial secondary element (Figure 75). Manufacture and gluing form roughly equal portions of the remainder. Most Near Eastern elements are utilised in application, with manufacture a large secondary element in the Neolithic period. Gluing dominates European Mesolithic elements, with unknown uses a majority of Neolithic evidence, with application a significant secondary factor.

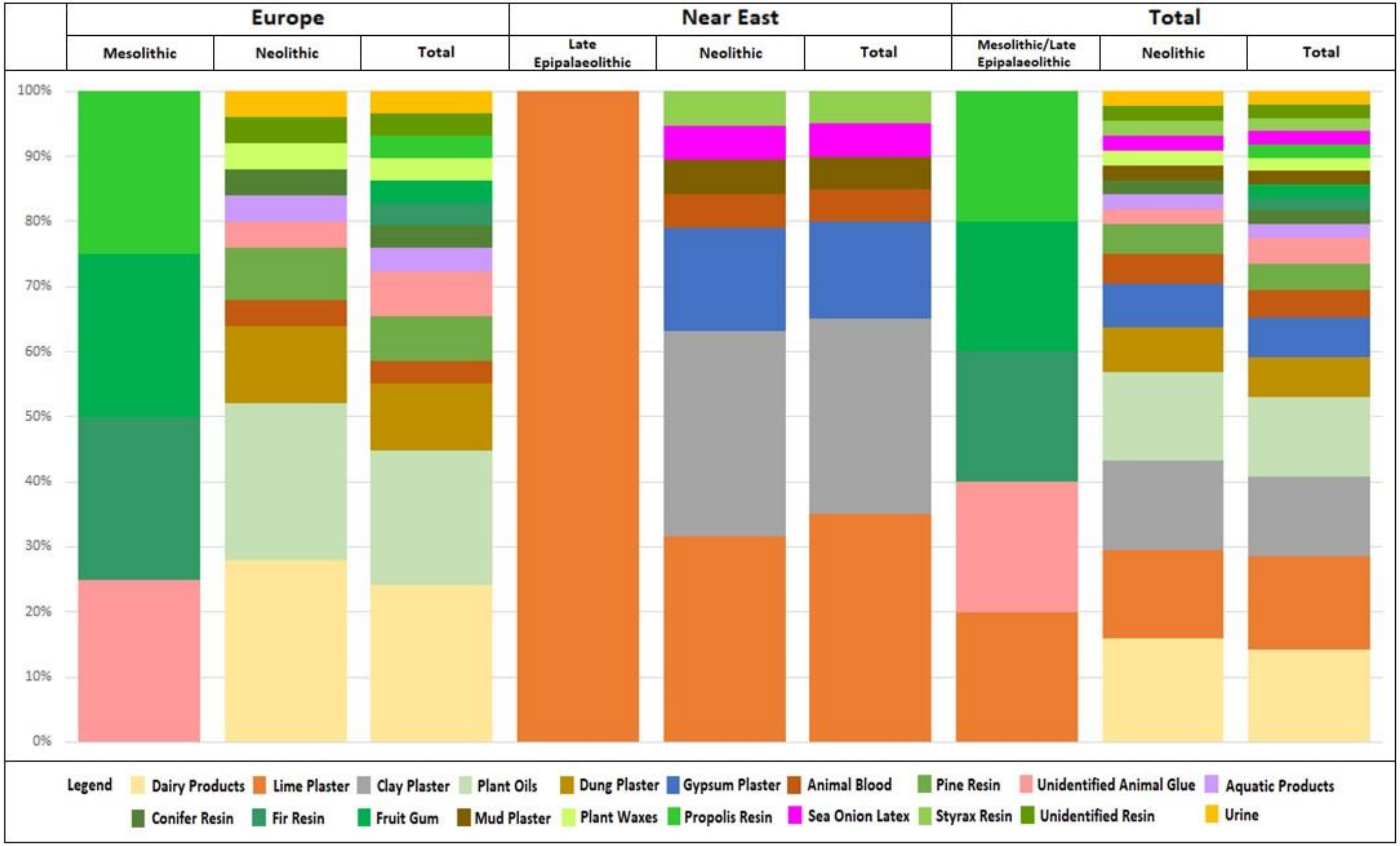


Figure 73. Types of other element, by region and period.

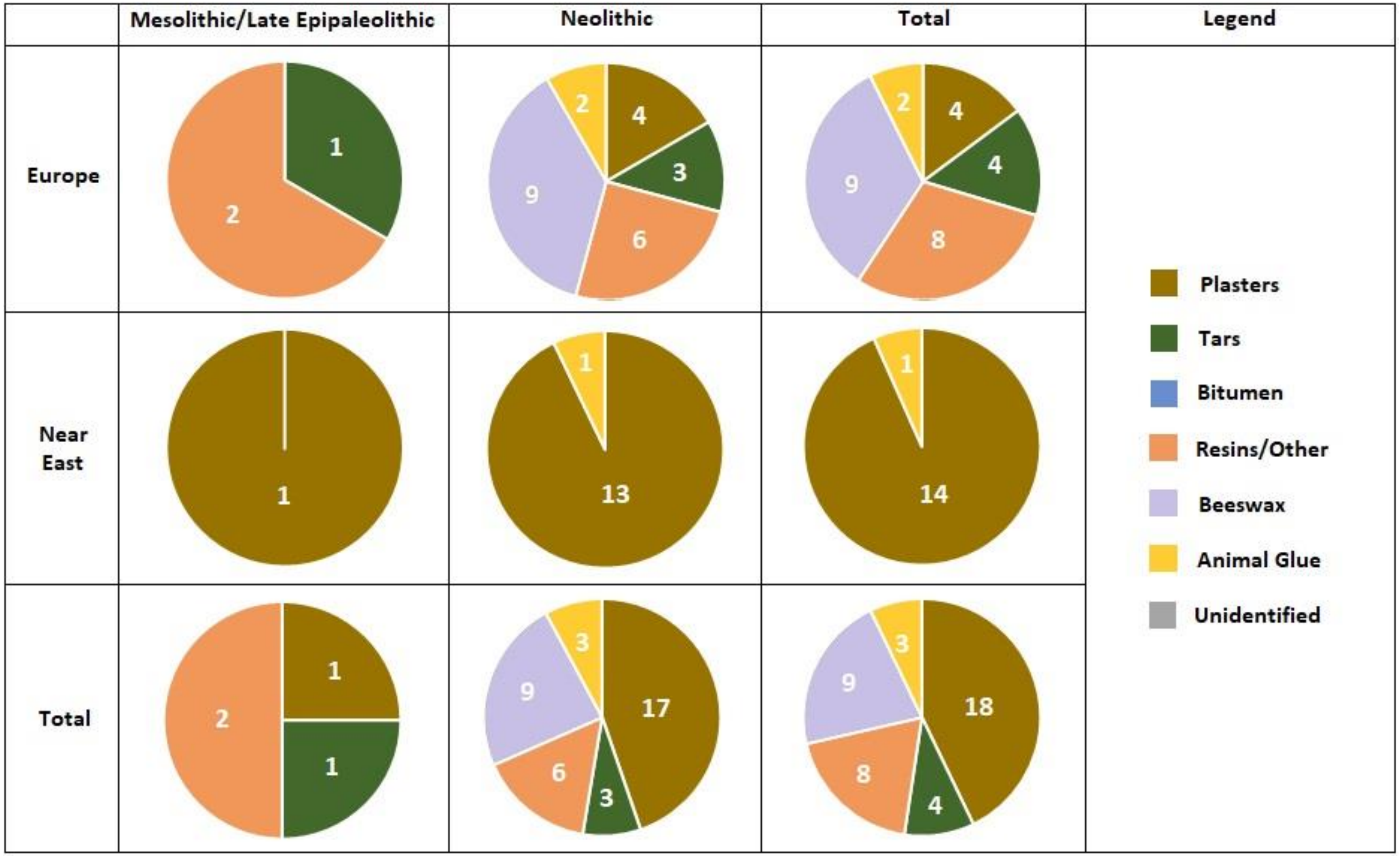


Figure 74. Other element use by general adhesive class, by region and period.

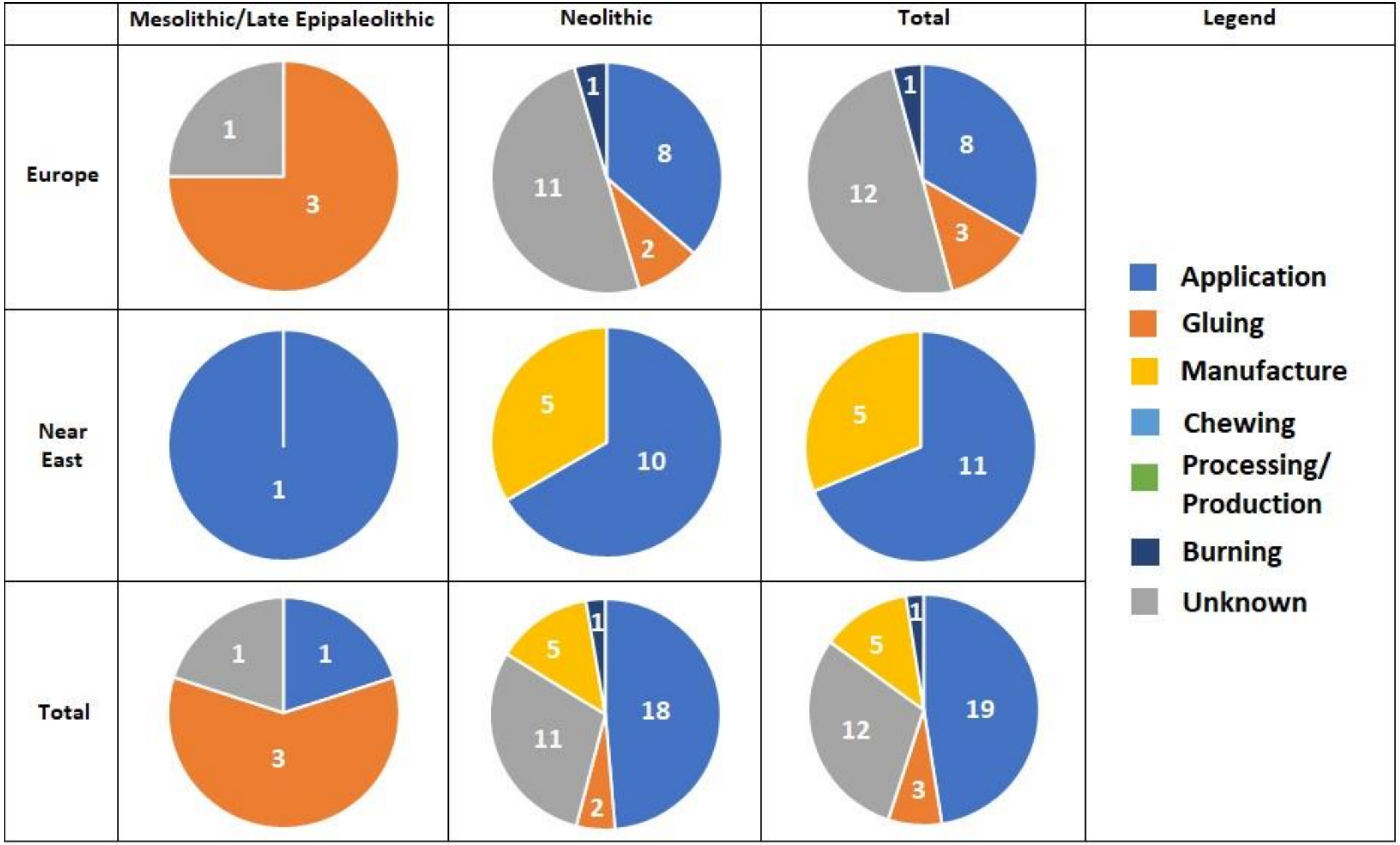


Figure 75. Other element use by general use type, by region and period.

4.13: Combined Additive Use

As Figure 76 demonstrates, aggregates and plasticisers occur infrequently in combination. Where combined use exists, it forms a larger element of European Mesolithic than Neolithic evidence and is wholly absent from the Late Epipalaeolithic. Half of all aggregate/plasticiser evidence comprises charcoal and beeswax added to resins.

Both appear more frequently combined with other elements with little difference shown temporally. However, plasticisers/other elements are limited entirely to Europe. Aggregates/other elements occur more frequently in the Near East although they exist in a small percentage of European sites. Plasticisers/other elements are largely animal fats/beeswax combined with dairy products, plant oils and occasionally resins, whilst aggregates/other elements are formed of various aggregates (significantly vegetal material) combined with plasters.

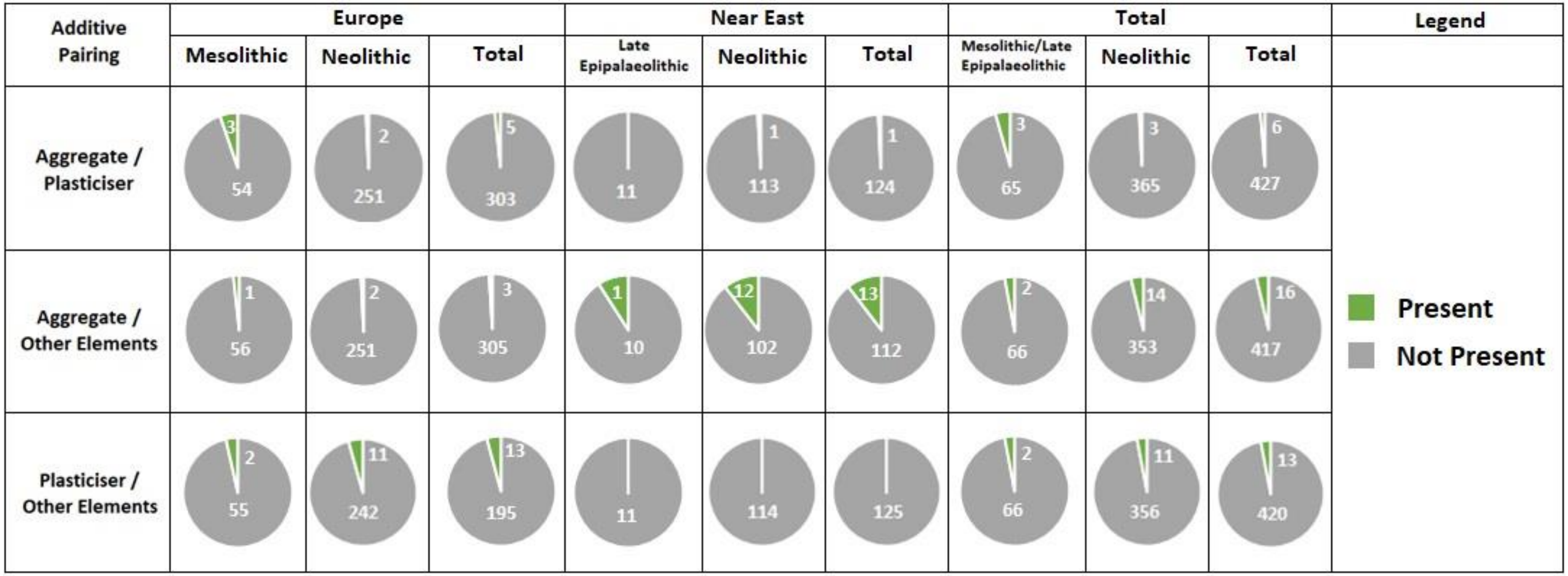


Figure 76. Sites attesting aggregates, plasticisers or other elements co-usage in the same adhesive, by region and period.

4.14: Summary

Archaeological adhesives attest significant patterning – greater evidence derives from Neolithic sites in both regions, with disparities evident in the spatial locations of Mesolithic/Neolithic sites in European contexts. Data is highly concentrated within regions – with European evidence clustering in Central Europe, the Balkans and Northern Greece, while Near Eastern data is largely restricted to the Fertile Crescent. This extends to individual adhesives – with European plaster evidence almost entirely from Central Europe or the Balkans and birch tars absent from Southern Europe.

Substantial continuity is present in adhesive classes across the Late Epipalaeolithic/Mesolithic and Neolithic – with birch tars preferred in Europe and bitumen utilised in the Near East, as initial analysis of literature (Chapter 2) suggested. However, the proportion of plaster and beeswax evidence significantly increases upon the Neolithic transition. Furthermore, European contexts display greater adhesive diversity – with animal glues, beeswax and resins more frequently attested. Adhesives see more substantial changes in use, with application and unknown uses increasing significantly in the Neolithic, especially in European contexts. Classes display clear patterning by use – plasters are heavily utilised in application roles, whereas roles for beeswax remain almost entirely unidentified. In both periods, additive use is minimal – with only modest increases in aggregate and other element content seen in the Near Eastern Neolithic.

5: Experimental Results

Below, the second results chapter outlines adhesive experiments designed to critique the archaeological data. These involved strength and water resistance testing of a broad range of adhesive substances deriving from the regions under analysis, with adhesive behaviour during assembly and failure also noted.

5.1: Adhesive Application

Resins, gums and other adhesives varied significantly in their properties (see Appendix 7). While both Chios mastic and conifer resins (pine and spruce) were easy to apply – with rapid drying times and minimal adhesive loss from dripping – they differed once dried. Without additives, conifer resins produced a heavily cracked and brittle exterior (Figure 77) while Chios mastic, being more viscous, did not suffer so. Cherry gum and myrrh were not initially adhesive upon application – creating difficulties with keeping blades positioned whilst drying. Frankincense and sandarac adhered poorly to object surfaces – repeatedly flaking off. Sandarac was also very difficult to physically apply and mix with additives due to its intensely coagulated nature. The addition of additives differentially impacted both adhesives, with sandarac seeing little impact while frankincense granules became embedded within a flexible waxy matrix. Acacia gum and gum tragacanth were easier to apply given their liquid nature but became highly brittle and patchy when dried – the former containing air bubbles.

Latexes also differed significantly. Asafoetida was initially quite runny but dried to produce a thin, heavily cracked layer while nettle latex was more viscous and produced a thick layer once dried. However, nettle latex suffered from rehydration and adhesive leakage before testing, whereas asafoetida was not affected. Additives improved both latexes considerably, producing more stable waterproof layers. Bitumen dried quickly upon application to produce a thick adhesive layer yet with brittle peripheral material – adhesive present on very flat surfaces or sticking out from between bindings being prone to snap away. Addition of additives prevented this from occurring by providing greater flexibility. Lime plaster and wheat starch were also easy to apply given their paste-like nature but were highly brittle once dried.

Labdanum appeared to behave more similarly to tars than resins, producing a firm yet malleable layer of adhesive. Birch/pine bark tars, however, differed in their longer drying times compared with other adhesives (more than a day) and issues with material running off the tool – likely the result of insufficient reduction before application. An earlier attempt to haft tools using even less reduced tars was entirely unsuccessful, with this refusing to dry and almost completely running off the tools. Additives further increased their flexibility (already considerable) but prevented leakage of adhesive.

Although easy to physically apply due to their runny nature, animal collagen glues were quite wasteful, with significant quantities of adhesive dripping off during drying. While deer collagen glues dried to form a thin but distinct layer of adhesive (Figure 77), trout collagen glues produced only a layer of residue, except under sinew bindings and immediately around the haft. Bone collagen glues differed for both species in producing a more brittle or indistinct layer of adhesive – with deer bone glue flaking off on light contact. The addition of additives disproportionately impacted deer collagen glues, forming a thicker and more flexible adhesive layer compared with fish glues which changed little in appearance beyond colour. Milk casein was easier to apply, as it formed a congealed mass upon heating that firmly concreted to the tool/haft surface and could be applied without adhesive loss. Additive content seemed to have little impact on adhesive appearance beyond colour. Cow blood was also more viscous but underwent significant changes with the addition of additives, changing from a thin layer of adhesive dried onto the tool-haft surface to a flexible puffy mass. Egg white glue consisted of a foamy mixture that was very difficult to apply – requiring significant spreading – and possessed limited adhesiveness until dried into a flaky/patchy layer. Additives were exceedingly difficult to combine with egg white glue, as heated beeswax began to cook the mixture requiring careful cooling to avoid this while also not solidifying the beeswax/charcoal before incorporation. Both plain and compound beeswax were also difficult to apply due to their exceptionally runny nature and rapid drying time (often drying onto the wooden teaspoon used to drip adhesive onto the tool). Plain collagen glues attracted insects during drying and storage – although this had no impact on adhesive integrity. Other animal-based adhesives lacked this issue, although milk casein glue experienced some mild surface discolouration (white patches possibly resulting from fungal action).

Environmental conditions during adhesive heating, application and drying remained relatively consistent between different adhesives (see Appendix 6). Temperatures varied between 6.4°C and 19.8°C, with average temperature being 12.3°C. Humidity varied more widely between 20% and 88% with an average of 54.8%. Most adhesives were applied during cloudy or overcast conditions (44% cloud, 40% part cloud) with 12% applied during sunny conditions. Acacia gum was applied during rainy conditions, which could potentially have negatively affected performance despite it having been prepared and dried under a substantial shelter preventing direct rain exposure. These conditions were as expected for the time of application, which was between March and April 2021.

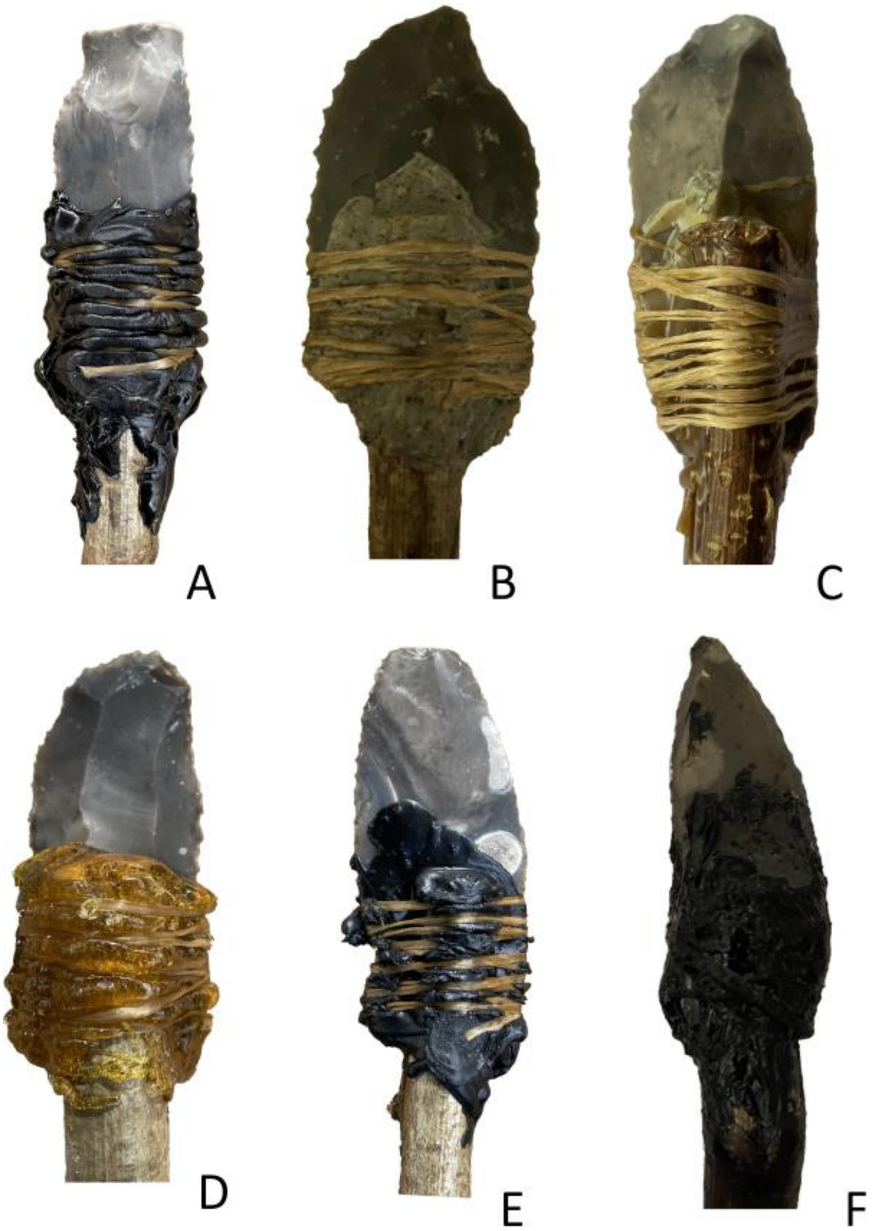


Figure 77. Examples of adhesives applied to haft tools: (A) plain bitumen, (B) plain milk casein glue, (C) plain deer hide glue, (D) plain pine resin, (E) compound pine resin and (F) plain birch bark tar.

5.2: Strength Testing

The majority of plain hafting adhesives (64%) failed within the first 15 minutes of testing – with the addition of beeswax and charcoal as additives having a significant impact on adhesive performance, with only 44% failing within the same timeframe (Table 6 and Figure 78). Improvements were more limited over longer timeframes, with only five individual adhesives lasting beyond an hour of testing regardless of whether additives were incorporated. Adhesive failure times formed distinct clusters, with resins/gums and various other adhesives (beeswax, lime plaster, nettle latex, etc.) all failing within the first hour of testing – largely within 15 or 30 minutes depending on the presence of additives (Table 6 and Figure 78). The majority of animal glues clustered around the 1-hour mark, sometimes ranging further if additives were added (Table 6 and Figure 78). Bitumen and tars, however, proved the most effective adhesives – all lasting for over 1 ½ hours of testing with compound bitumen adhesive lasting for just over 2 hours (Table 6 and Figure 78).

Many adhesives failed almost instantaneously within the first five minutes of testing. Of these, frankincense and sandarac in particular exhibited very poor adhesion to other surfaces, flaking off the haft area in solid chunks – a problem which also impacted adhesive application. Plain nettle latex also exhibited issues with remoistening as a result of flints heating up during sawing – causing it to become exceptionally sticky. A number of resins/gums were more resilient – with acacia gum, cherry gum, conifer resins (pine and spruce) and labdanum lasting from between 8 and 30 minutes without additive content. Chios mastic differed considerably from other adhesives when utilised plain, lasting for over 45 minutes, perhaps a result of its noticeably greater viscosity and lack of surface cracking during use. Labdanum exhibited certain properties (appearance, malleability) more in common with tars than other resins, but was less resilient than them, lasting just under 30 minutes. Although compound bitumen proved the most effective adhesive overall, birch and pine tars were stronger when utilised in a plain state due to the brittler nature of plain bitumen, which caused it to fail considerably earlier.

Animal-based glues typically proved more resistant than resins/gums but varied significantly based on type, species and even body parts used for collagen extraction. Hide/skin glues lasted considerably longer than bone glues (2,812.33% deer plain, 543.68% deer compound, 40,614.3% trout plain, 10,062.5% trout compound) which were brittle and exhibited poor surface adhesion with the addition of additives. While trout skin glue was surprisingly effective given it formed only a thin layer of residue, deer hide glue was more resilient. Milk casein glue exhibited performance similar to plain deer hide glue. However, a number of other animal-derived glues (beeswax, bone collagen glues, cow blood glue and egg white glue) exhibited greatly limited strength by comparison.

Additives considerably impacted adhesive performance, although to varying degrees. Brittle resins and gums were impacted heavily, with the performance of conifer resin such as pine or spruce resin considerably improved (349% and 290.6% respectively). Acacia gum, frankincense and myrrh also saw significant improvements (2821.05%, 306.1% and 254.6%). In the case of frankincense, this was particularly massive as it suspended the weakly bonded adhesive granules within a flexible waxy matrix, taking the adhesive from failure within a minute to almost twenty minutes of sawing. It was impossible to assess the impact of additives upon Chios mastic, as the haft of the tool split violently during testing, causing premature adhesive bond failure.

Moderate impacts were attested on bitumen (131.8%) and animal-based adhesives such as deer hide (151.9%) and milk casein (119.8%) glues – with improved flexibility allowing deer hide glue to compete with bitumen and bark tar adhesives in performance. Bitumen was noticeably less brittle with the addition of additives, with ridges of adhesive sticking out from sinew bindings no longer snapping off. However, the addition of additives to trout skin glue (113.3%) and various other adhesives (asafoetida – 132.7%, beeswax – 137.6% - gum tragacanth - 60%, lime plaster – 460.8%, nettle latex –

114.9%, sandarac – 378.9%, trout bone glue – 457.1% and wheat starch – 245.1%) – despite bringing improvements of 300-400% in some instances – resulted in near imperceivable changes in adhesive performance given the short failure times these adhesives had to begin with. In some instances, the addition of beeswax negatively impacted adhesive performance, with highly flexible adhesives such as birch/pine tar (-20.74% and -11.61%) and labdanum (-40.12%) having this property noticeably exacerbated to the point of earlier tool failure. This may be the result of the quantity of additives added, which may (in retrospect) have been set too high as a proportion of the total mixture at 25% each. Lower proportions of beeswax in particular might have resulted in less dramatic changes in flexibility and improved rather than reduced the strength of adhesives. Beeswax also seems to have altered the drying of cherry gum, producing a more flexible but less firmly adhered layer.

	Failure Time		Resharpening	
Adhesive	**Plain**	**Compound**	**Plain**	**Compound**
Acacia Gum	00:08:21	00:25:34		
Asafoetida	00:01:56	00:02:34		
Beeswax	00:02:41	00:01:57		
Birch Bark Tar	01:56:11	01:32:05	1	1
Bitumen	01:39:29	02:11:10	1	2
Cherry Gum	00:21:08	00:08:29		
Chios Mastic	00:50:34	00:25:09*		
Cow Blood	00:01:16	00:00:48		
Deer Bone	00:02:26	00:19:07		
Deer Hide	01:08:25	01:43:56		1
Egg White	00:00:12	00:00:21		
Frankincense	00:00:38	00:17:52		
Gum Tragacanth	00:00:25	00:00:10		
Labdanum	00:27:35	00:16:31		
Lime Plaster	00:01:37	00:07:27		
Milk Casein	01:03:45	01:16:34		
Myrrh	00:09:33	00:24:19		
Nettle Latex	00:04:35	00:05:16		
Pine Bark Tar	01:47:31	01:35:02	2	
Pine Resin	00:11:07	00:38:52		

Sandarac	00:00:19	00:01:12
Spruce Resin	00:11:26	00:33:14
Trout Bone	00:00:07	00:00:32
Trout Skin	00:47:23	00:53:40
Wheat Starch	00:00:31	00:01:16

Table 6. Failure rates of flint tools hafted with plain and compound adhesives. * = *Tool failed prematurely*.

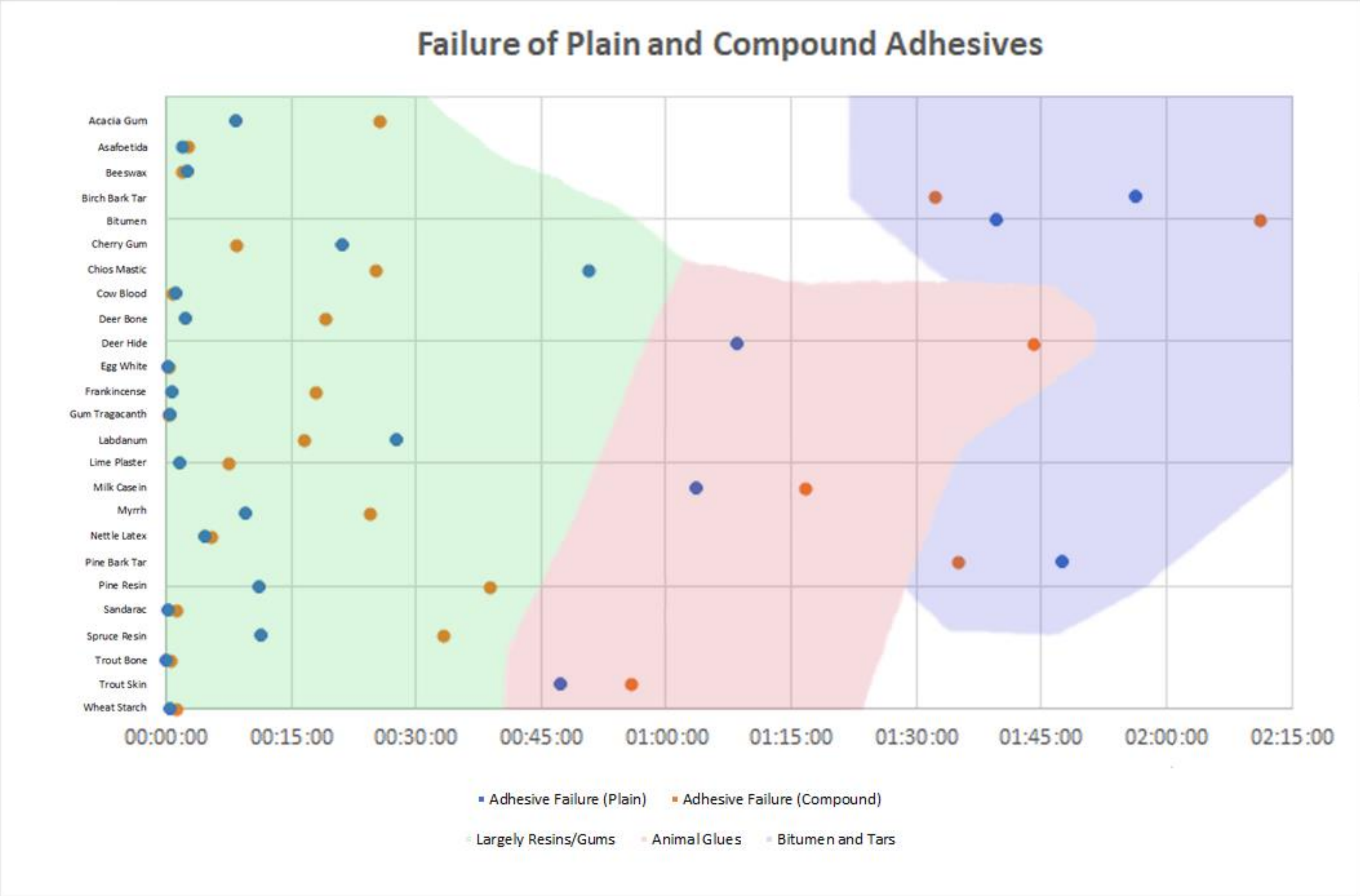


Figure 78. Distribution of plain (blue) and compound (orange) adhesive failure rates.

5.3: Failure and Adhesive Residues

Adhesives differed significantly in how they failed and residues left behind on tool dehafting (Table 7). 52% of plain adhesives snapped (or fell, if surface adhesion was poor) from the haft causing instant tool loss. However, many (28%) had sufficient flexibility or strength (largely from the thickness of adhesive) to retain tools in place on failure and the high flexibility of certain plain adhesives (20% - deer hide glue, labdanum, nettle latex and tars) caused tools to gradually loosen until sliding out of alignment, requiring readjustment. Where they formed a substantial layer, brittle adhesives (such as lime plaster, conifer resins and wheat starch) suffered significant adhesive loss within the last minute of sawing before failing – with a third of applied plain conifer resin pinging off the haft area. Additives had a mixed impact on failure. 36% - largely resins/gums – demonstrated greater adhesion upon failure, being held in place upon snapping rather than falling loose. In the case of cow blood glue, bitumen and frankincense, greater flexibility caused tools to merely loosen or shift sideways rather than snap. However, the majority (48%) saw no change regardless of failure type and 12% (all collagen glues) saw less adhesion – snapping in place or falling loose. Apart from lime plaster, addition of beeswax to adhesives prone to loss before failure prevented this occurring.

Tools were dehafted to assess adhesive preservation in potential cases of repair and reuse. Removal of tools from hafts greatly impacted residue preservation – 36% of plain adhesives suffered severe adhesive loss due to a combination of both failure and dehafting (mainly animal glues, brittle resins/gums and wheat starch). Frankincense and sandarac (8%) suffered total adhesive loss. Although quite flexible, deer hide glue had minimal residue present due to loosening of the flint tool from its adhesive. Chios mastic and conifer resins had little solid adhesive present beyond a faint powdery residue (Figure 79). 28% suffered moderate adhesive loss, constituting a wide range of adhesive types, with another 28% suffering minimal adhesive loss. Better preserved adhesives largely consisted of those firmly concreted to tool surfaces like milk casein, myrrh or trout skin glue and sticky adhesives like nettle latex and tars (Figure 79). Most loss for better-preserved adhesives (that did not flake off) occurred in the centre of the tool directly under the haft, which pulled off adhesive upon removal (see Figure 79, A and B).

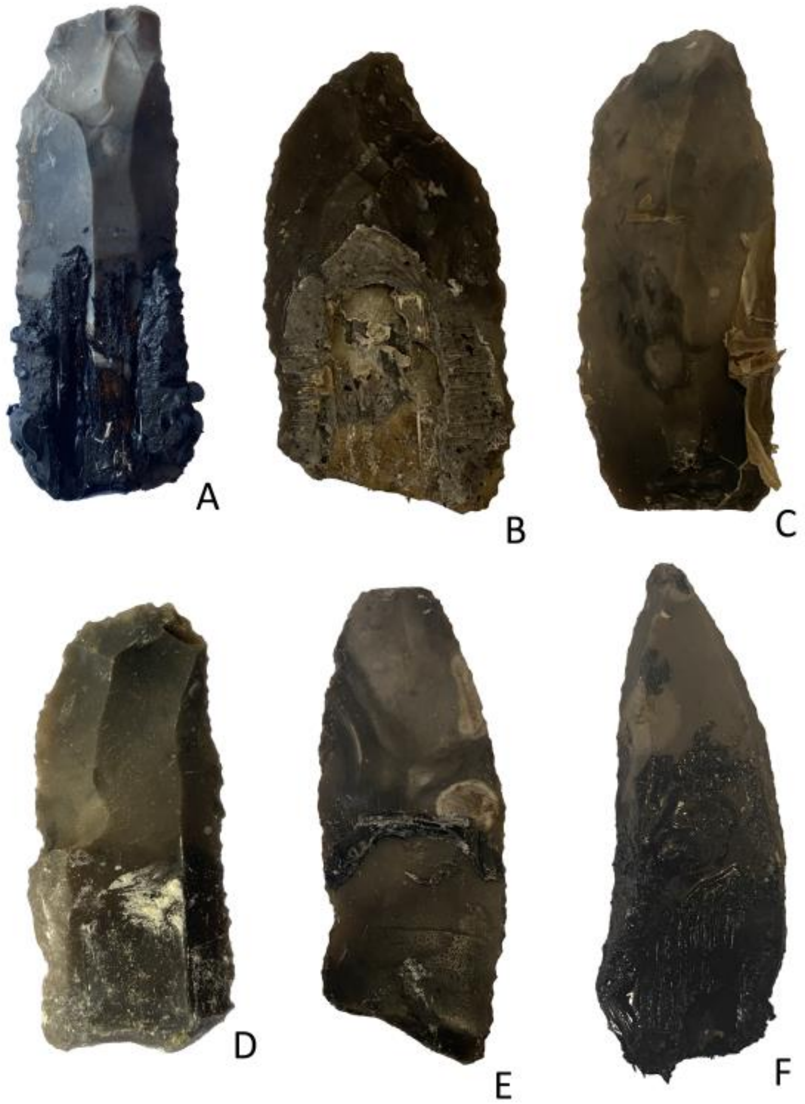


Figure 79. Adhesive residue preservation on (A) plain bitumen, (B) plain milk casein glue, (C) plain deer hide glue, (D) plain pine resin, (E) compound pine resin and (F) birch bark tar.

As with adhesive failure, addition of additives had a variable impact on residues – with 32% of adhesives seeing improved residue survival. Largely consisting of brittle resins and deer collagen glue, these improvements were moderate in nature except for frankincense and sandarac – which had no surviving residue present when hafted plain. 40% of adhesives, however, saw poorer preservation. Milk casein experienced the worst decline, going from minimal to severe adhesive loss, with additives increasing its flexibility and reducing adhesive concretion onto the tool. Residues produced by conifer resin varied with the addition of additives, with pine resin having improved preservation while spruce resin declined to almost total loss – likely a product of natural variation in performance given only one tool was sampled per adhesive. 28% of adhesives saw no change in preservation from additive content – most constituting those already at the extreme ends of adhesive preservation.

	Failure Type		Adhesive Loss	
Adhesive	**Plain**	**Compound**	**Plain**	**Compound**
Acacia Gum	Snapped Off	Snapped in Place	Severe	Moderate
Asafoetida	Snapped Off	Snapped in Place	Moderate	Minimal
Beeswax	Snapped in Place	Snapped in Place	Moderate	Severe
Birch Tar	Loosened in Place	Loosened in Place	Minimal	Moderate
Bitumen	Snapped in Place	Loosened in Place	Moderate	Severe
Cherry Gum	Snapped Off	Snapped in Place	Moderate	Moderate
Chios Mastic	Snapped in Place	Failed Prematurely	Severe	Moderate
Cow Blood	Snapped in Place	Shifted in Place	Moderate	Severe
Deer Bone	Snapped Off	Fell Off	Severe	Moderate
Deer Hide	Loosened in Place	Snapped in Place	Severe	Moderate
Egg White	Snapped Off	Snapped Off	Severe	Severe
Frankincense	Snapped Off	Loosened in Place	Total	Moderate
Gum Tragacanth	Snapped Off	Snapped in Place	Severe	Severe
Labdanum	Loosened in Place	Loosened in Place	Minimal	Moderate
Lime Plaster	Snapped Off	Snapped Off	Moderate	Moderate
Milk Casein	Snapped in Place	Snapped in Place	Minimal	Severe
Myrrh	Snapped in Place	Snapped in Place	Minimal	Moderate
Nettle Latex	Loosened in Place	Loosened in Place	Minimal	Minimal
Pine Tar	Loosened in Place	Loosened in Place	Minimal	Minimal
Pine Resin	Snapped Off	Snapped In Place	Severe	Moderate

Sandarac	Fell Off	Fell Off	Total	Severe
Spruce Resin	Snapped Off	Snapped in Place	Severe	Total
Trout Bone	Snapped Off	Fell Off	Moderate	Severe
Trout Skin	Snapped in Place	Snapped in Place	Minimal	Minimal
Wheat Starch	Snapped Off	Snapped Off	Severe	Total

Table 7. Adhesive failure and loss on flint tool dehafting.

5.4: Resistance Testing

Water resistance testing assessed the ability of adhesive substances to withstand water exposure, concentrating on two distinct variables – survival of adhesive bonds, assessed by the time taken for two glued wooden cubes to separate, and residue survival on the surface of these cubes.

Most plain adhesive bonds failed swiftly on exposure to water (36% within 5 minutes, a further 24% within 15 minutes) with only 28% surviving a full 24-hour exposure (Table 8). These consisted of bitumen, deer hide glue, frankincense, labdanum, milk casein and both tars. Surprisingly, given its brittle nature, frankincense lasted the full test duration.

Compound adhesive failure was more widely distributed. Only lime plaster (4% of the total) failed within 5 minutes exposure. An addition 12% failed within 15 minutes. Although only 32% survived the full period of testing (not an appreciable increase), a greater number were distributed across the entire testing period (20% by 1 hour, another 12% by 3 hours, a further 12% by 6 hours and 8% by the 12-hour mark). The specific adhesives that lasted the full duration of testing did not change, with labdanum actually declining in performance due to surface cracking. Therefore, while greatly improving the ability of certain adhesives (largely thin or brittle animal glues and resins/gums with cracks allowing water infiltration) to withstand water exposure for a longer period, addition of additive content did not enable survival for the full testing period (Figure 80). 56% saw improved water resistance – of these Chios mastic, conifer resins, cow blood glue and deer bone glue saw the most drastic – moving from failure within about 15 minutes to withstanding over 6 hours exposure. Many adhesives (36%) saw no difference in failure time, but 2/3 of these had already lasted the full duration of testing and could therefore experience no performance improvement. The remainder tended to be thin/brittle adhesives (acacia gum, asafoetida, trout skin glue). 8% of adhesives were detrimentally affected by additives, with labdanum and myrrh both seeing 50% reductions in survival.

Adhesive residues – by contrast – lasted considerably longer than bonds, with 52% of plain and 88% of compound adhesives surviving the testing period. A large minority (36%) of plain adhesives were lost within 15 minutes exposure – with gum tragacanth, nettle latex and wheat starch decaying particularly rapidly, within 5 minutes. A smaller number (12%) failed around the 30 minutes / 1 hour mark (acacia gum, asafoetida, cow blood glue). Of those that survived full testing, addition of additives greatly improved residue survival (Figure 80). 48% of adhesives experienced increases in failure time from compound addition, with 40% seeing substantial improvement - from failure within minutes to surviving the whole test duration. None failed below the 30-minute mark, with only adhesives exhibiting very poor performance when tested plain failing to survive the test period (lime plaster, wheat starch) – apart from beeswax. 48% of adhesives saw no improvement but these consisted entirely of those previously lasting the full test duration. Beeswax went from lasting the full test period to failure within an hour – probably due to added charcoal improving its internal strength. Whilst plain beeswax gradually flaked away in small chunks, leaving some degree of residue retention, compound beeswax came off entirely in large pieces causing total residue loss.

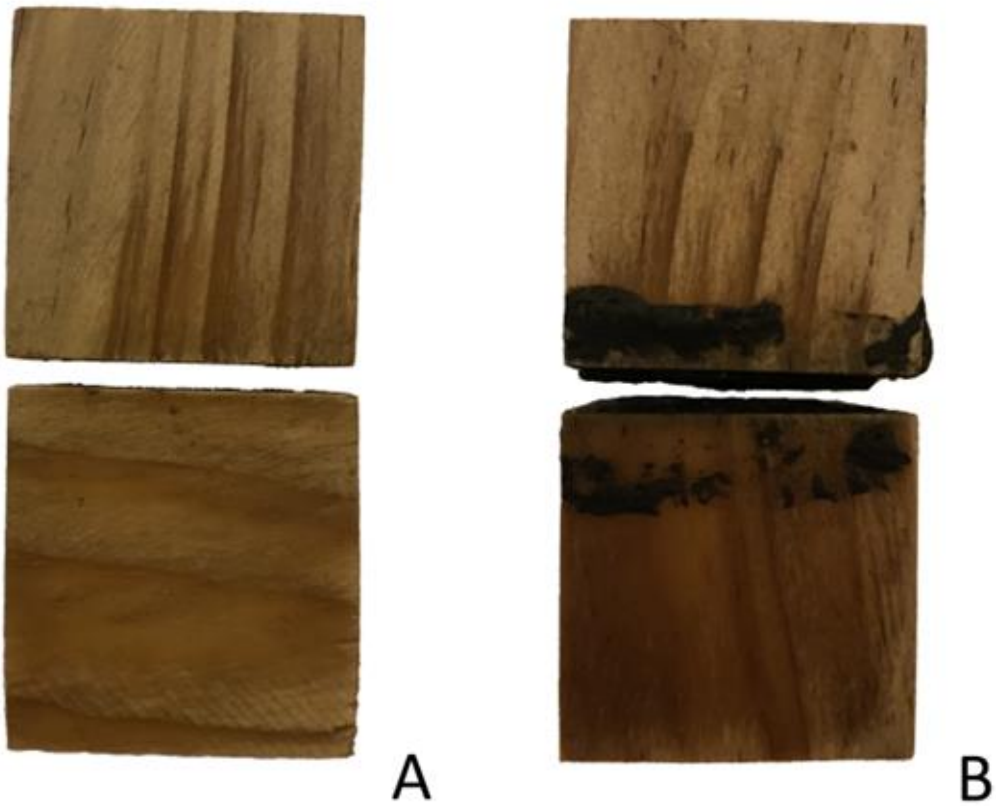


Figure 80. Adhesive residue preservation on (A) plain and (B) compound deer bone glue.

Flexible or more solid adhesives (bitumen, deer hide glue, milk casein glues, both tars) experienced minimal issues with adhesive bond failure and residue preservation from water exposure. Brittle, thinner or more soluble adhesives saw more issues, as water penetration through cracks wore away material or dissolved plain adhesives (like cow blood glue, nettle latex or wheat starch) directly. Additives (mostly beeswax) greatly improved their ability to withstand water exposure – although most still suffered some surface residue loss (Figure 80). While beeswax itself appeared to resist water action strongly – floating in the container used for testing – it easily detached from cube surfaces, causing bond failure and total residue loss. Most animal glues (bone collagen glue, cow blood glue and trout skin glue) survived poorly on water exposure – suffering rapid bond failure and minimal residue survival without compound additives – deer hide and milk casein glues (both plain and compound) survived water exposure in all instances. While milk casein glue experienced no visual change, the exterior of deer hide glue became gelatinous over time, although this did not affect bond integrity or surface adhesive preservation. However, while deer hide glue dried upon conclusion of the experiments without issues, milk casein glue was rapidly affected by mould.

	Failure Time Intervals			
	Adhesive Bond		**Residues**	
Adhesive	**Plain**	**Compound**	**Plain**	**Compound**
Acacia Gum	<01:30:00	<01:30:00	<00:30:00	N/A
Asafoetida	<00:15:00	<00:15:00	<00:30:00	N/A
Beeswax	<00:05:00	<01:00:00	N/A	<01:00:00
Birch Bark Tar	N/A	N/A	N/A	N/A
Bitumen	N/A	N/A	N/A	N/A
Cherry Gum	<00:05:00	<03:00:00	<00:15:00	N/A
Chios Mastic	<00:05:00	N/A	N/A	N/A
Cow Blood	<00:15:00	<12:00:00	<01:00:00	N/A
Deer Bone	<00:15:00	<06:00:00	<00:15:00	N/A
Deer Hide	N/A	N/A	N/A	N/A
Egg White	<00:05:00	<06:00:00	<00:15:00	N/A
Frankincense	N/A	N/A	N/A	N/A
Gum Tragacanth	<00:05:00	<00:30:00	<00:05:00	N/A
Labdanum	N/A	<12:00:00	N/A	N/A
Lime Plaster	<00:05:00	<00:05:00	<00:15:00	<00:30:00
Milk Casein	N/A	N/A	N/A	N/A
Myrrh	<00:30:00	<00:15:00	N/A	N/A
Nettle Latex	<00:30:00	<03:00:00	<00:05:00	N/A
Pine Resin	<00:15:00	N/A	N/A	N/A
Pine Bark Tar	N/A	N/A	N/A	N/A

Sandarac	<00:05:00	<00:30:00	N/A	N/A
Spruce Resin	<00:05:00	<06:00:00	N/A	N/A
Trout Bone	<00:05:00	<00:30:00	<00:15:00	N/A
Trout Skin	<00:15:00	<00:15:00	<00:15:00	N/A
Wheat Starch	<00:15:00	<00:30:00	<00:05:00	<06:00:00

Table 8. Failure time intervals of adhesive bonds and residues exposed to water over a 24-hour period.

5.5: Summary

Experiments indicated significant differences in adhesive performance, with tars/bitumen by far the most effective, both resistant to high stress tasks and naturally water-resistant. This broadly aligns with archaeological data showing their near overwhelming predominance. Resins/gums were less strong and generally failed/disintegrated upon prolonged water exposure when tested plain, but experienced significant improvements upon addition of additives, in both experimental categories. Animal glues were typically stronger, but experienced issues upon water exposure, with the exception of deer hide glue which recovered from repeated episodes of wetting and drying over a 24-hour period without lasting effects. Considerable differences were noted in adhesive working properties and behaviour upon application, as well as failure and disassembly – with animal glues/resins leaving behind minimal traces upon purposeful tool dehafting.

6: Adhesives and the Neolithic Transition

The discussion chapters below synthesise the results of archaeological site database analysis and experimental testing to achieve thesis objectives. Here, Chapter 6 assesses continuity and difference in adhesive usage between the Late Epipalaeolithic/Mesolithic and Neolithic in both European and Near Eastern contexts, utilising experimental data to critique the archaeological record. This involves consideration of various factors – adhesive performance, utilisation of analytical techniques and contexts of preservation that could bias the archaeological record. Chapter 7 specifically examines regional differences across both periods, considering availability of adhesives. Finally, Chapter 8 assesses evidence for adhesive production and the extent to which this can be conclusively identified in both aceramic and ceramic contexts.

6.1: Archaeological Adhesives

Whilst considerable imbalance exists between quantities of Mesolithic and Neolithic sites in European contexts, Mesolithic data (deriving from 57 sites) is sufficient to evaluate differences between the two periods with confidence. However, the limited extent of Late Epipalaeolithic data – from just 11 sites – may be considered insufficient for meaningful conclusions to be drawn regarding developments in adhesive usage outside the very broadest changes. Regional differences may impact the validity of temporal comparisons – little overlap exists between Mesolithic and Neolithic sites in Europe; the former clustering in Northern Europe whilst Neolithic adhesives largely originate from Central Europe and the Balkans. By contrast, Late Epipalaeolithic sites, despite concentrating heavily in the Levant region, overlap significantly with Near Eastern Neolithic data. The extent to which temporal comparisons can be made in European contexts is debatable, as environmental differences could influence adhesive choices and produce temporal contrasts artificially.

Tars and bitumen comprise the majority of non-architectural adhesives across both periods, varying according to regional contexts, with bitumen use infrequent in Europe and tars wholly absent from Near Eastern sites. However, whereas a majority of tars have been identified via chemical analysis, bitumen evidence is less robust. Although most Late Epipalaeolithic/Mesolithic bitumens have been chemically identified, Neolithic evidence has largely been interpreted from physical examination, or no analysis whatsoever. This suggests the possibility of misidentification – supported by evidence from the Pre-Pottery Neolithic site of Nahal Hemar, where adhesive material was initially identified as bitumen without detailed analysis (Connan, Nissenbaum and Dessort, 1995; Bar-Yosef and Alon, 1988). However, later chemical analyses of the same material have indicated use of bovine collagen glue to produce baskets and styrax resin to decorate skulls, despite a bitumen source being present in the immediate site vicinity (Solazzo *et al.*, 2016; Connan, Nissenbaum and Dessort, 1995). This scenario could be replicated elsewhere, with insufficient chemical analysis concealing greater adhesive diversity than believed. By contrast, greater prevalence of birch tars compared with pine and beech/oak tars is strongly supported by chemical analysis – with alternatives limited entirely to Neolithic contexts. However, their Mesolithic absence may result from greater quantities of material obtained from Neolithic sites - applying Neolithic non-birch tar percentages onto existing Mesolithic evidence, one would find only a single site. Furthermore, most non-birch tars have been utilised in application or unknown contexts, less prevalent in the Mesolithic compared with gluing evidence. The near total absence of bitumen from architectural contexts makes sense considering its material properties – weak bonding with mudbrick/earthen surfaces, susceptibility to fatigue and tendencies to flow at temperatures above 40°C – making it unsuited for architectural use (Van de Velde, 2015b; Maheri *et al.*, 2011).

While resins and unidentified adhesives form similar percentages of evidence in both periods, significant differences in resin uses and sub-types are attested. Mesolithic resins remain largely unidentified, detected via optical microscopy of lithic surfaces. In contrast, significant quantities of Neolithic resin identifications arise from chemical analysis of trace residues on ceramics, yielding largely pine resins. It remains unclear if Neolithic evidence represents a significant departure from Mesolithic contexts due to the nature of analytical techniques employed - with the largest identified sub-type comprising generic conifer resins. The nature of microscopic traces ensure that most resins have no interpretable use, compared with Mesolithic evidence largely deriving from hafting contexts. However, significant increases in resin application derive from microscopic traces interpreted as suggesting vessel sealing/waterproofing.

Unidentified adhesives largely remain unidentified due to lack of detailed analysis – although a significant minority were chemically analysed but not satisfactorily identified. These almost entirely relate to gluing evidence, specifically hafting. Loose and sometimes contradictory use of adhesive terminology within many papers can also make precise identification difficult - some may refer to chemically identified tars as resins or interchangeably refer to resins and pitches (David, 2018; Larsson, Sjöström and Heron, 2016; Zhilin, 2017; Slah, 2014; Kjellström *et al.*, 2010). Some papers may utilise terms like bitumen, resin, pitch or tar to refer to completely unidentified adhesives mentioned without significant analysis, further confusing matters (Galili *et al.*, 2013; Rimkus, 2018; Pesonen, 1996; Merpert and Munchaev, 1973). Nahal Hemar demonstrates adhesives can easily be confused without chemical analysis – making use of specific terminology unwise without supporting evidence, even if certain adhesives may dominate evidence within a region or time period.

Although plasters constitute the largest adhesive class, most have not been analysed chemically or via optical microscopy, leaving a significant element without an identifiable sub-type. However, it seems unlikely that most plasters could be easily confused with other adhesives, except maybe if used as elements of other adhesive mixtures. European plaster use increases dramatically upon the Neolithic transition, corresponding with a rise in application evidence. This almost entirely relates to architectural use – with emergence of more permanent structures necessitating increased plaster use to waterproof/seal buildings (Maheri *et al.*, 2011; Kingery, Vandiver and Prickett, 1988). By contrast, plaster use forms a majority of Near Eastern adhesive evidence from the Late Epipalaeolithic onwards, albeit in a more diverse range of use contexts. Late Epipalaeolithic/Mesolithic plasters represent a narrower range of uses and sub-types – either a result of geographical differences, preservation issues or limited data (see Chapter 7) – with European evidence entirely comprised of clays incorporated into other adhesives as plasticisers. However, these plasters have been more definitively identified – largely chemically analysed or examined microscopically to confirm their presence in earlier contexts. Lime plasters comprise the largest single use category at Near Eastern sites, followed by gypsum, then clay and mud – broadly corresponding to the differing water-resistant qualities of each plaster (Kingery, Vandiver and Prickett, 1988; Gourdin and Kingery, 1975).

Both animal glues and beeswax are far more frequently attested in Neolithic contexts and well identified from heavy use of chemical analysis – their frequency, uses and contexts vary significantly. Animal glues derive from just a handful of Neolithic sites – with a significant portion attested by a single study examining paint binders in Sardinian megalithic tombs (Rampazzi *et al.*, 2007). Pre-existing Mesolithic use of animal glues is certainly possible without use of ceramic containers – for example, at Dvoinaya cave in Southern Russia – as aceramic containers can be utilised for collagen glue production (see Chapter 8). Although casein glues remain absent from both contexts, milk exploitation by hunter-gatherer populations is demonstrated as early as the MSA, which attests a milk-ochre mixture on a stone flake (Villa *et al.*, 2015). Like resins, beeswax identification heavily relies on microscopic residues present on ceramic material analysed in lipid studies, yielding no context as to their actual purpose. This is attested by the sizeable growth in unknown Neolithic use contexts. A smaller amount of application evidence interprets beeswax as a sealing agent applied to waterproof ceramic vessels. Beeswax is often found mixed with animal fats, dairy products, plant oils and other substances – possibly resulting from multiple phases of ceramic usage. However, sugars present in some samples may imply use of honey or honeycomb processing in ceramic containers – as attested in ethnographic studies where honeycomb is boiled in containers to separate wax (Adriani and Kruijt, 1951; Turrado Moreno and Muirden, 1945; Tauxier and Brunel, 1912).

Lacking evidence of changing uses, it is likely that provision of a more stable preservation surface explains increased beeswax in Neolithic contexts, whereas bark and other aceramic containers used to prepare/utilise beeswax (see Chapter 8) and other materials did not survive for analysis. Mesolithic contexts attest beeswax utilisation, but solely as plasticisers in other adhesives.

Overall, adhesive uses change significantly with the Neolithic transition – but this can be broadly attributed to the presence of ceramics and differing forms of analysis. Far greater evidence for adhesive application is present – largely due to the emergence of ceramics preserving adhesive traces (in container decoration, sealing contexts) with additional growth in unidentified uses due to chemical identification of microscopic traces on ceramics without clear signs of use. Repairing significantly increases in Neolithic gluing contexts due to increasing ceramic evidence – with only a handful of Mesolithic examples, such as a repaired amber figurine, attested. Other uses remain similar across both periods – for instance, chewing sub-types remain near identical due to the speculative nature of processing/medicinal identifications without clear indicators.

Additive use does not differ significantly between Mesolithic and Neolithic contexts – being utilised in only a minority of adhesives. However, aggregates and other elements do increase significantly in the Near Eastern Neolithic, largely from incorporation of mineral content and other plaster types into mixtures used in architectural contexts. Plasters benefit considerably from incorporation of more flexible plasters and aggregate elements, which can add strength (Gliozzo, Pizzo and La Russa, 2021; Kingery, Vandiver and Prickett, 1988). However, a significant proportion of aggregate content could result from natural inclusions, or incidentally derive from preparation contexts – perhaps attested by the frequency of multiple aggregate types in the same mixtures. Little aggregate patterning is evident across periods – although charcoal forms a significant percentage of total Late Epipalaeolithic/Mesolithic evidence, the limited volume of aggregates attested from this period prohibits solid conclusions. It is difficult to reconcile the absence of widespread additive use in chemically analysed adhesives – such as resins/tars – with experimental data (see below) indicating they improve adhesive performance. While an increased proportion of animal fats are attested in Neolithic contexts, these relate to traces detected alongside beeswax on ceramics that cannot definitively be attributed plasticiser functions or even identified as deliberate admixture. Incorporation of other elements (adhesives, dairy/plant residues) is limited in Late Epipalaeolithic/Mesolithic contexts – largely consisting of resin admixture with other resin/tar adhesives – whereas Neolithic contexts are more diverse, attesting either mixture of different plasters or residues detected on ceramic material alongside beeswax.

On the whole, remarkable continuity seems evident between Late Epipalaeolithic/Mesolithic and Neolithic adhesive usage in a number of areas. Birch bark tar remains the principal non-architectural adhesive in Europe, with bitumen and plasters dominating Near Eastern contexts. However, less detailed analysis of bitumen in Near Eastern Neolithic contexts raises the possibility of misinterpretation concealing greater adhesive variation. A number of changes are discernible – largely the product of shifting adhesive uses, preservation contexts and methods of analysis employed. Plasters – comprising a tiny percentage of European Mesolithic evidence – become the largest single adhesive category in the region during the Neolithic, with corresponding increases in application uses attested due to their predominance in architectural roles. Beeswax and resins also increase significantly – largely from chemical detection of microscopic traces on ceramic materials. This corresponds with a rise in the percentage of unknown uses in Neolithic contexts – as purely microscopic residues cannot be easily interpreted. Other uses such as chewing/gluing do not decline, markedly increasing in sheer number terms, but being outpaced by greater growth in other use categories in the Neolithic. Incorporation of additives into adhesive mixtures remains small across both periods – although slight increases in aggregates and other elements is attested for the Neolithic, largely related to increased plaster utilisation. In the case of other elements, some component of this increase derives from chemical analyses of ceramic material identifying dairy products or plant oils in combination with beeswax residues. While the archaeological record seems to indicate little change in adhesive usage overall, do experimental results support or contradict these findings?

6.2: Performance and Preservation

Experimental findings broadly correlate with previous studies examining adhesives. Birch tars exhibit considerably greater strength than conifer resins, with Kozowyk and Poulis (2019) observing greater performance than plain pine rosin or compound mixtures with beeswax or ochre. Directly comparing their results for similar periods of adhesive heating, this study observed birch tar outperformed composite pine resins by a factor of 3x – similar to their observation of birch tar outperforming rosin/beeswax mixtures by a factor of 2x (Kozowyk and Poulis, 2019). Differences may result from differing experimental setups. Kozowyk and Poulis (2019) conducted lap shear tests in laboratory environments, whereas this study tested hafted tools to destruction. Actualistic testing required periods of rest, sometimes several hours, which may have extended adhesive use-life artificially. Failure criteria might also play a role – adhesive failure was determined when a tool movement of 1cm or greater was observed, with most adhesives lasting beyond an hour showing signs of movement long before failure occurred. If different materials – e.g., wooden strips or metal plates – were used, adhesive failure might have occurred when initial movement began. Adhesive layers also received additional reinforcement from sinew bindings and split wooden tool hafts. Other experiments involving acacia gum and birch/pine tars broadly correlate with experimental results – with birch/pine tars showing ability to resist similar forces and plain acacia gums forming thin, brittle layers containing air bubbles (Kozowyk, Poulis and Langejans, 2017; Wadley, 2005).

Preferential usage of tars/bitumen for high stress tasks (gluing, etc.) in archaeological contexts broadly corresponds with experimental results demonstrating these adhesives to be the most effective analysed - both waterproof and capable of withstanding over 1.5 hours sawing wooden logs before failure. While plasters are less well-suited to high stress tasks, failing within minutes, this property appears to have been exploited to enable deliberate projectile point detachment on impact at sites like Tell Halula (Borrell and Stefanisko, 2016; Borrell and Molist, 2007). Despite substantial technological and societal changes brought by the Neolithic transition, the same adhesives would appear to have been used due to their superior qualities – further supported by their continued predominance across prehistory, from the earliest attested usage of adhesives in Middle Palaeolithic times into the Iron Age (see Chapter 2) (Courel *et al.*, 2018; Manclossi, Rosen and de Miroschedji, 2016; Rageot *et al.*, 2015; Pawlik and Thissen, 2011a; Dinnis, Pawlik and Gaillard, 2009; Boëda *et al.*, 2008). Clearly, this must result from taphonomic biases or better performance justifying their continued use across millennia, rather than cultural factors. The predominance of birch tars, however, does not appear to correlate with either actualistic results from this study or lap shear tests conducted by Kozowyk, Poulis and Langejans (2017), both indicating similar performance to pine bark tars in room temperature conditions. If correct, it remains unclear why birch tars would be so heavily utilised – especially in Neolithic Greece where birch was less common and located in upland areas away from sites like Makriyalos 1 and Paliambela, where pine tars and resins were also utilised to a lesser extent (Urem-Kotsou *et al.*, 2018). Differential preservation may play a significant role – experiments by Kozowyk, van Gijn and Langejans (2020) demonstrate pine tars experience worse preservation than birch over the course of just three years buried or discarded in surface contexts, which may also contribute to the prevalence of tars more generally compared with resins or animal glues. However, superior material properties might also explain preferential use of birch, with pine tars more sensitive to temperature changes, becoming almost unusable above 38°C (Kozowyk, Poulis and Langejans, 2017). Higher tar yields obtained for birch by Kozowyk, van Gijn and Langejans (2020) may also explain preferential selection. Clearly, further research is required to fully explain the extent to which differential preservation affects tar varieties and the role material properties play in this discrepancy.

However, one major difference is evident – animal glues are practically absent from the archaeological record, while hide/skin collagen and milk casein glues sit intermediate in strength between resins and tars/bitumen, both of which are frequently attested. While water exposure can damage the effectiveness of animal glues, rendering bone/fish glues inoperable in water resistance experiments – deer hide and milk casein glues were able to withstand 24 hours of exposure, involving multiple phases of drying and rehydration, without adhesive loss or bond failure. Casein glues, however, proved highly vulnerable to mould in the aftermath of water exposure. The behaviour of some animal glues upon failure could explain adhesive absence – tools hafted with deer hide glue failed due to adhesive loosening away from flint surfaces, adhering more strongly to wooden hafts, potentially minimising lithic residues. However, fish, blood and casein glues left substantial residues behind. Predominantly, their absence is likely a result of their organic nature not lending itself to archaeological preservation (Kozowyk, van Gijn and Langejans, 2020). Flakes bearing bone/hide glues left buried or exposed to surface conditions by Kozowyk, van Gijn and Langejans (2020) suffered total adhesive loss within just six months, with a handful of exceptions. Archaeological finds consist of either collagen glues deriving from waterlogged or arid preservation contexts or egg binders detected in paints (Solazzo *et al.*, 2016; Bleicher *et al.*, 2015; Rampazzi *et al.*, 2007).

It might be expected that animal glues usage would increase upon transition to the Neolithic – with more immediate and continual access to bones/hides/sinews and milk from domesticates. Glue production could, for example, permit utilisation of spoiled milk or scraps of material. Blood glues could have played similar roles to plaster adhesives attested in Near Eastern contexts – comparably weak adhesives utilised to detach projectile points upon impact. These involve fairly simple preparation (blood mixed with alkali, such as ash from hearths) whilst addition of beeswax/charcoal during experiments waterproofs the resulting adhesive. Such use is occasionally attested ethnographically – with Aleut and Inuit hunter-gatherers hafting arrows using blood (Jochelson, 1933; Cadzow, 1920). However, the ease with which blood glues could be differentiated from incidental residues archaeologically can be questioned - protein analysis utilised in detection of blood residues may not reveal incorporated alkali or plasticiser elements (Fiedel, 1996; Hyland *et al.*, 1990; Loy and Wood, 1989; Newman and Julig, 1989). Conversely, it seems unlikely that bone glues were utilised in either context – while brittle like blood glues, the greater effort required for their production would not be commensurate with their utilisation. It proved impossible to leech collagen from red deer bone without prolonged exposure to strong acid, potentially excluding bones from larger mammals (such as cattle, sheep, etc.) entirely in favour of fish/birds/small mammals. However, this result depends on a small sample size focusing on just two species and collagen samples from Neolithic Nahal Hemar seem to more closely match bone than skin collagen (Solazzo *et al.*, 2016).

Resins – especially when utilised plain without additives – exhibited poor performance compared with tars/bitumen. While beeswax/charcoal additives significantly extended tool use-life (by a factor of 2x in most instances) and improved water resistance, it appears likely the innate strength and water-resistant qualities of tars/bitumen promoted their more frequent use, despite greater effort required for tar production. It is also likely that greater reusability of tar adhesives promoted preferential usage, with resins becoming more brittle once heated above 100-150°C (Kozowyk and Poulis, 2020). Furthermore, unlike tars, resins behave poorly at both low and high temperatures, respectively either too brittle or too soft (Kozowyk and Poulis, 2020). Resins (and other brittle adhesives, such as bone glues and plaster adhesives) had a greater tendency to snap away from hafts on failure, rather than remaining in situ like tars/bitumen and hide glues – which might discourage use due to potential accidental tool loss. Some plain resins (conifer resins, Chios mastic) also suffered considerable adhesive loss in the minutes prior to experimental failure from dust and small resin fragments pinging off haft surfaces - not easily recoverable for potential reuse. Taphonomic factors may also play a role – experiments by Kozowoyk, van Gijn and Langejans (2020) and Croft *et al.* (2016) demonstrate that while pine resin preservation is not exceptionally poor, it is still significantly less than tars over a 3-year period, with addition of additives (generally lacking in the Mesolithic/Neolithic archaeological record) assisting greatly with resin detection. Resins also suffered more severe adhesive loss on deliberate dehafting (for reuse of sinew bindings, wooden hafts, adhesive material, etc.) – with only thin residues or patches of solid adhesive present (Figure 81) compared with tars/bitumen which (compound bitumen aside) saw most adhesive remain adhered to tool surfaces. This largely arose from removal of sinew bindings, rather than wooden hafts, which only pulled away material from directly beneath them. Bindings, by contrast, pulled material away from the entire haft area in small chunks, causing heavy adhesive loss. This could be very significant – as preservation experiments by Kozowyk, van Gijn and Langejans (2020) demonstrate unhafted tools preserve adhesive residues less well to begin with. On the whole, absence of resins could broadly be attributed to the superior qualities of tar/bitumen adhesives – although taphomonic issues may well affect their detection.

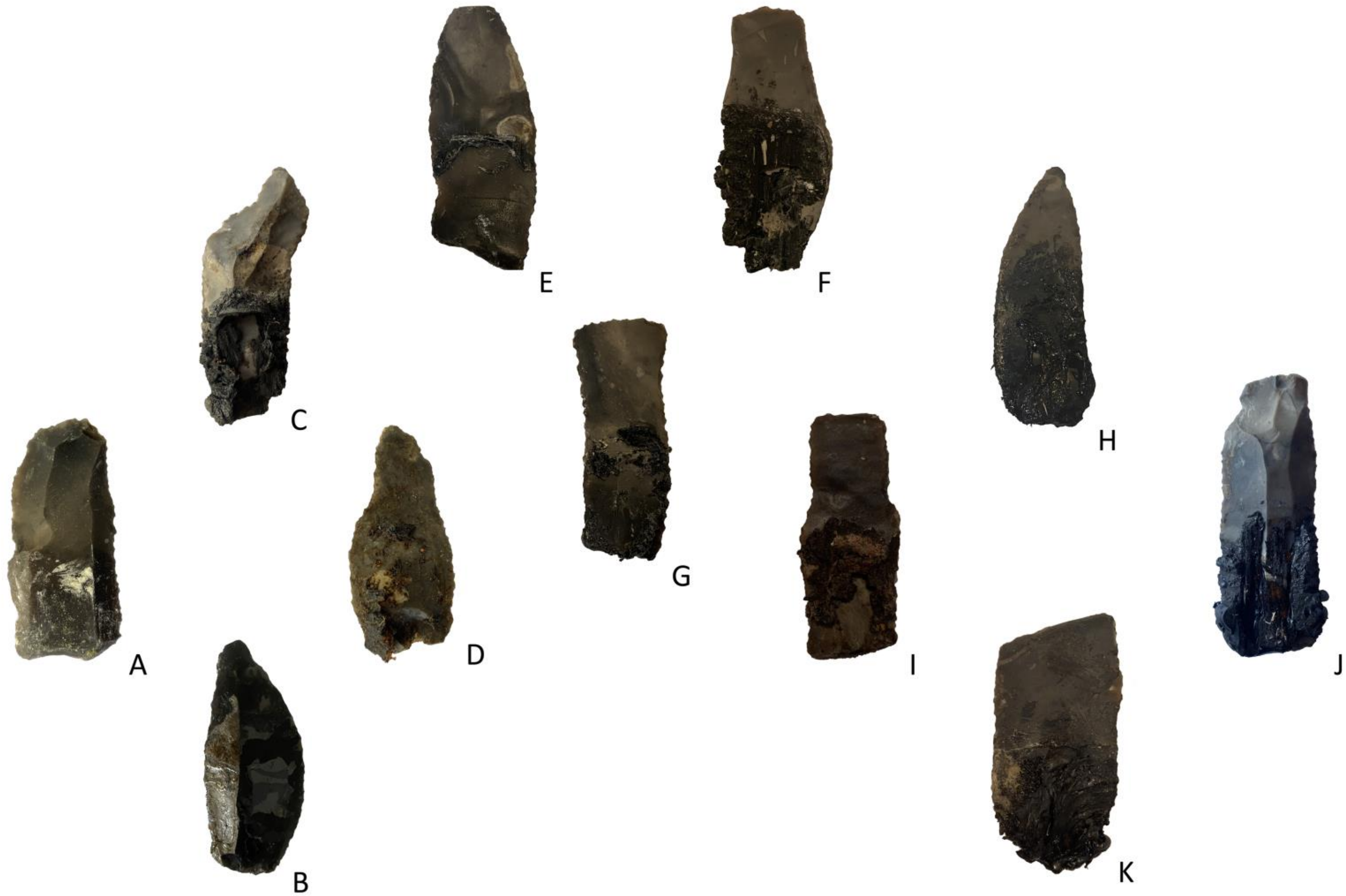


Figure 81. Residues present on plain resins (A, B, C, D), compound resins (E, F, G, I) and plain tars/bitumen (H, J, K) upon dehafting.

Pine constitutes the vast majority of identified resins – use of conifer resins aligns with their greater strength compared to other resins/gums but fails to explain preferential usage of pine over spruce or other species – given fairly similar experimental performance. Both would have had broadly similar European distributions (see Chapter 7). One factor could be the greater resistance of pine resin to water exposure, with adhesive bonds lasting roughly three times longer than spruce when assessed without additives – although given this result is based on just two samples, it is hardly conclusive. The almost total absence of other effective resins (cherry gum, Chios mastic, labdanum) does not correlate with their performance - equivalent or greater than conifer resin. In particular, Chios mastic – a form of Pistacia resin – proved particularly resilient. Although its composite version failed prematurely and could not be accurately assessed, plain Chios mastic lasted longer than any other resin (plain and composite) making its total absence outside resination/waterproofing contexts difficult to explain.

Other adhesive types – such as starch glues, latexes and beeswax - performed poorly but could have been used to purposefully detach projectile points. While plant latex use appears unlikely, due to the effort required to concentrate adhesives – and starch glues, due to their friability - beeswax may have been used for this purpose, with an example present in earlier Upper Palaeolithic contexts at Bergkamen on a projectile point (Baales, Birker and Mucha, 2017). Absence from gluing contexts, save as plasticisers, could be explained by poorer beeswax preservation compared to resins/tars in experiments conducted by Kozowyk, van Gijn and Langejans (2020). Suggestions of beeswax application to waterproof vessels remains uncertain – this study, together with experiments by Soberl *et al.* (2014), demonstrate beeswax as ill-suited for long-lasting sealing as it is prone to flaking away if cracks develop. Water exposure gradually worked away at beeswax present on the surface of wooden cubes. However, plain beeswax (as attested archaeologically in ceramics) flaked off gradually in chunks and could potentially be easily renewed by reheating to smooth over affected areas.

Most adhesive types experienced significant performance improvements on addition of additives – particularly resins such as frankincense, acacia gum and conifer varieties. While explaining the greater proportion of resins attesting aggregate/plasticiser content archaeologically, the finding fails to explain absence of these elements outside a small number of sites. Although some adhesives experienced only minor improvements, these had largely failed within minutes when tested plain, with additives doing little to alter this. However, highly tensile adhesives such as birch/pine tars and labdanum suffered decreased performance from additive addition, pushing already too flexible adhesives beyond their limits. It appears certain that additives should have been more widely detected – given chemical analysis has been performed on a majority of resin/tar adhesives - although unidentified adhesives, encompassing a significant degree of gluing evidence, have not been chemically analysed to any great degree. Furthermore, preservation experiments by Kozowyk, van Gijn and Langejans (2020) demonstrate addition of coloured aggregates (such as ochre) greatly improves macroscopic identification of resins – suggesting the archaeological record should be biased in their favour. So why the absence? The greater relative strength of tars/bitumen might not necessitate the effort of collecting/incorporating aggregate or plasticiser materials for additional performance – only more brittle tars, for instance, may have required plasticiser incorporation. However, the relative ease by which aggregate content could be sourced (charcoal/ash from hearths, for instance) argues against this. While the presence of aggregates/plasticisers in just a small proportion of resins overall would argue against their common use – as resins benefit more extensively – most resins derive from ceramic material which might reflect use contexts not requiring additional adhesive strength, especially flavouring which might be negatively impacted by addition of ash/charcoal. Potentially, preservation issues could affect additive detection or identification, but such evidence is lacking. More research is required to reconcile experimental performance with limited archaeological data.

6.3: Summary

Overall, adhesive use appears little changed by the Neolithic transition. The same principal adhesives – birch tar and bitumen – continue to be preferred for high stress tasks in Europe and the Near East respectively. Whether this reflects prehistoric reality, however, remains uncertain. Taphonomic factors could significantly bias archaeological assemblages in favour of more robust adhesives, like tars/bitumen. Increases in other adhesive types (beeswax) and uses (unknown uses, application) are probably attributable to changing use contexts, with ceramic development providing a more stable surface preserving residues for chemical analysis. It remains unclear if this reflects increased use, as aceramic containers would not survive well. One major development relates to increased plaster usage in architectural roles, particularly in Europe, due to greater use of permanent structures by Neolithic societies. However, insufficient chemical analysis of bitumen adhesives raises the possibility their abundance is overstated, with potential changes obscured. Experimental work appears to support preferential selection of tar/bitumen adhesives for high stress tasks due to greater strength and innate water-resistant properties, despite greater time investment needed for tar production. Although animal glues are practically absent, despite their effectiveness, this probably results from poor archaeological preservation. Additive usage remains low in both Late Epipalaeolithic/Mesolithic and Neolithic archaeological contexts, largely restricted to plasters in the latter context, despite chemical analyses performed on a sizeable proportion of adhesive evidence.

7: Regional Differences

As with temporal differences, regional concentration of sites limits the applicability of evidence in European and Near Eastern contexts. Absence of significant data from Southwestern Europe – Spain and Italy – may conceal adhesive usage differences, as the modern range of birch (Betula) species is generally limited to Northern Iberia and alpine Italy (Figure 82). Although processed birch tar could be acquired via trade, absence of birch forest may have encouraged use of other adhesives, such as pine tars or resins. Such limited evidence as is present appears to support this, with bitumen use in Central/Southern Italy and pine resins – albeit largely from application contexts – dominant in Iberia. Similarly, little or no site data is attested from the Eastern Balkans, Ukraine and Russia. Near Eastern evidence is restricted to the Fertile Crescent – with a band of sites running from the Southern Levant up to the Zagros Mountains, then down to Kuwait and the Persian Gulf. Evidence from the Arabian Peninsula, most of Anatolia and the Caucasus is lacking – which may conceal significant differences in adhesive utilisation (see below). Overall, less diversity of adhesives is seen in Near Eastern contexts, which are dominated heavily by bitumen and plasters. Combined, the largest two adhesive classes constitute less than 50% of European but 80% of Near Eastern adhesives. The principal adhesives differ – birch tars being preferred in Europe and bitumen in the Near East – each largely or wholly absent in the other regional context. Chapter 6 observed this might result from analytical techniques employed, differential preservation or genuine performance differences. But what of adhesive availability?

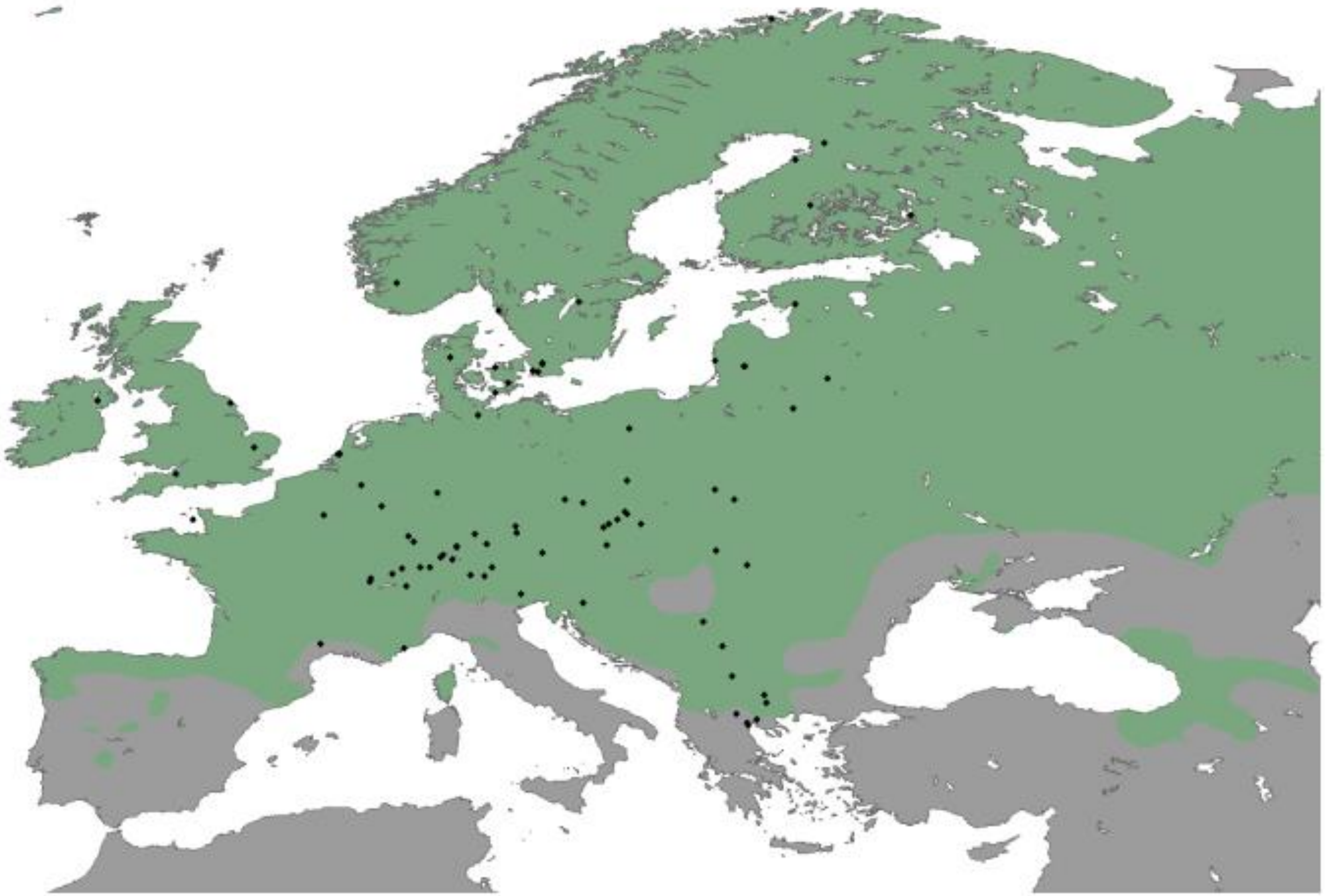


Figure 82. Modern range of birch species (in green) compared with sites attesting birch tar adhesives (Caudullo, Welk and San-Miguel-Ayanz, 2017).

Analytical issues aside, bitumen prevalence is supported by widespread distribution of sources in Near Eastern contexts – and their close correspondence with archaeological data. The principal source (Arabian) runs from Eastern Syria down through Iraq, terminating in Oman and Northern Yemen, covering a large portion of site data (Figure 83). Sources in the Dead Sea region (Dead Sea), Western Georgia (Amur) and Turkmenistan (South Caspian) also correlate with use evidence (Figure 83). Bitumen usage in the Northern Levant is difficult to assess – despite its distance from sources, a general lack of site data hinders interpretation. However, bitumen must have been imported into Çatalhöyük, which sits more distant from sources in Central Turkey (Figure 83).

European bitumen similarly correlates with source distribution – although several sources are present, they cover smaller areas than in the Near East. Concentration of evidence along the Alps and in the Northern/Southern Italian Peninsula is supported by the presence of the Molasse, Po, South Adriatic and Taranto sources in these areas (Figure 83). However, adhesive evidence is generally lacking from regions containing other bitumen sources, such as Northwestern Germany (Northwest Germany) and Slovakia/Romania (Carpathian) – making assessment of their use difficult. Potential differences in bitumen quality or working properties between different sources could affect its utilisation over different adhesives (Paliukaitė, Vaitkus and Zofka, 2014; Connan and Van de Velde, 2010; Singh and Jain, 1997). Possible bitumen usage is attested at Friesack, which sits on the periphery of the Northwest German source, and bitumen present in Eastern Hungary could derive from Carpathian sources. Exploitation of the latter source is demonstrated by earlier finds of bitumen at Middle/Upper Palaeolithic Gura Cheii-Rasnov and Early Bronze Age Adânca and Gorgota, all in Romania – both preceding and immediately following the periods under review (Cosac *et al.*, 2013; Cârciumaru *et al.*, 2012). Additional bitumen sources are attested in Sicily (Caltanissetta), along the Dalmatian Coast (South Adriatic), Southern Ukraine/Russia (North Caucasus-Mangyshlak) and in the Ural Mountains (Volga-Ural, North Caspian) on the periphery of

European Russia (Figure 83) – all lacking significant adhesive evidence. Presence of bitumen sources near Hungary and on the Dalmatian Coast would coincide with a lack of birch forest, as extrapolated from modern distribution (Figure 82), perhaps leading to its greater use.

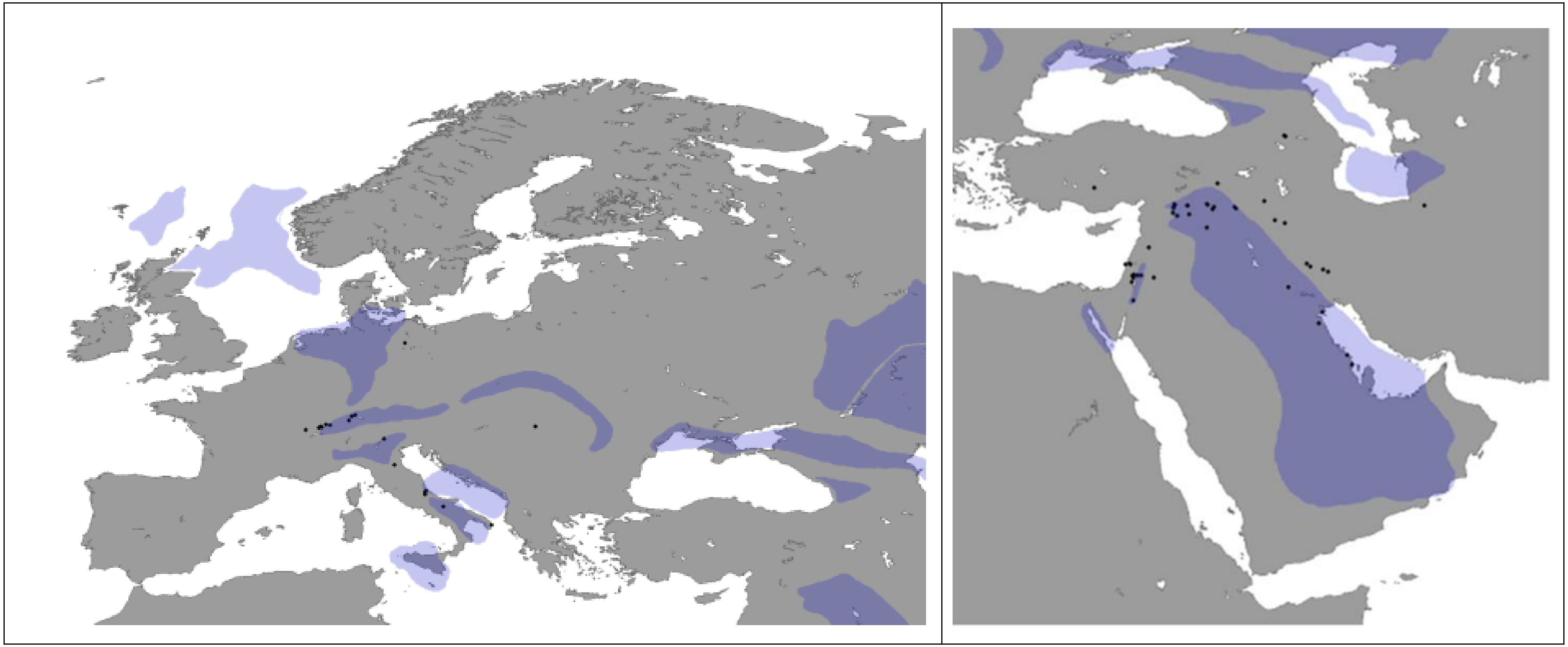


Figure 83. Major European and Near Eastern bitumen sources (in blue) compared with sites attesting bitumen (Hein *et al.*, 2013; Meyer, Attanasi and Freeman, 2007).

Beeswax, resin and tar evidence is largely or wholly absent from Near Eastern sites - largely from lack of chemical analysis of Later Neolithic ceramics that might preserve such residues, with the majority of evidence deriving from aceramic contexts. Just 3 instances of beeswax usage and 4 of resin are known – despite Apis species and resins being present across the region (Beaurepaire *et al.*, 2020; Caudullo, Welk and San-Miguel-Ayanz, 2017; Civeyrel *et al.*, 2011). The near total absence of resins is harder to explain – as significant gluing and object application uses remain attested outside ceramic contexts in Europe. As noted in Chapter 6, this may result from insufficient chemical analysis of bitumen adhesives concealing resin evidence. Despite what the archaeological evidence would suggest, considerable resin variety is present (Figure 84). Conifer resins such as pine, cedar and fir are present – albeit restricted to Turkey's Northern Coast, the Caucasus and the Mediterranean Coast of Syria, Lebanon and Northern Israel (Caudullo, Welk and San-Miguel-Ayanz, 2017). Furthermore, resins/gums like acacia gum (Acacia, Senegalia and Vachellia species), Chios mastic (Pistacia) and labdanum (Cistus) demonstrating equal or greater effectiveness than conifers in high stress tasks are present in Turkey and the Levant, with Pistacia extending further east into Iran (Civeyrel *et al.*, 2011; Lorenzo, González and Reigosa, 2010; Golan, 2009; Ross, 1981). Styrax (Styrax) and Storax (Liquidambar) resins – albeit unassessed – also occur regionally (Caudullo, Welk and San-Miguel-Ayanz, 2017; Hovaneissian *et al.*, 2006). Prunus species are also present – with cherry gums attested in Northern Turkey and almond gums across the whole Near East (Caudullo, Welk and San-Miguel-Ayanz, 2017; Delplancke *et al.*, 2016). The concentration of adhesive evidence within the Fertile Crescent may hamper understanding of adhesive utilisation away from bitumen sources, which coincides with greater resin presence in Turkey and Northwestern Syria.

In particular, lack of evidence from Turkey hinders understanding of changing adhesive usage – birch tars are attested as far south as Northern Greece and bitumen as far west as Central Turkey – is there a dividing line? Does tar use extend eastwards into Anatolia, matching distribution of birch/conifer species? While beech/birch species are limited to the Caucasus and Northeastern Turkey (Figure 84) conifers are present in the Northern Levant alongside other tar-producing species such as Hazel, Hornbeam, Oak, Elm and Alder (Figure 84) – with the latter three extending into the Southern Levant. Given limited evidence of Near Eastern resin usage, tar adhesives could also be present. However, greater vulnerability of certain tars to higher temperatures might discourage usage in hotter climates (Kozowyk, Poulis and Langejans, 2017). Experimental understanding of different tar behaviours, beyond birch and pine, hinders interpretation of their potential usage.

Frankincense (Boswellia) and myrrh (Commiphora) are limited to Southern Arabia (Figure 84), which attests no adhesive evidence before the historic period (Arie *et al.*, 2020; Bongers *et al.*, 2019; Evershed *et al.*, 1997). Their probable utilisation, compared with bitumen, is difficult to judge – although myrrh exhibited performance comparable with conifer resins, frankincense demonstrated poor adhesion without added plasticiser elements. Bitumen sources are generally restricted to Eastern Arabia – its absence on the western coast might have promoted use of resins/gums such as acacia and juniper (Figure 84) or transportation of bitumen from eastern sources or the Dead Sea region. Preferential usage of bitumen over resins for high stress tasks due to its greater resilience seems likely, however the limited evidence from Eastern Arabia demonstrates no exploitation of local bitumen sources in the Arabian interior, with geochemical analysis indicating Kuwaiti origins (Van de Velde *et al.*, 2015a; Connan *et al.*, 2005). However, as the vast majority of this derives from boat caulking remnants, it may result from disassembly outside original production contexts.

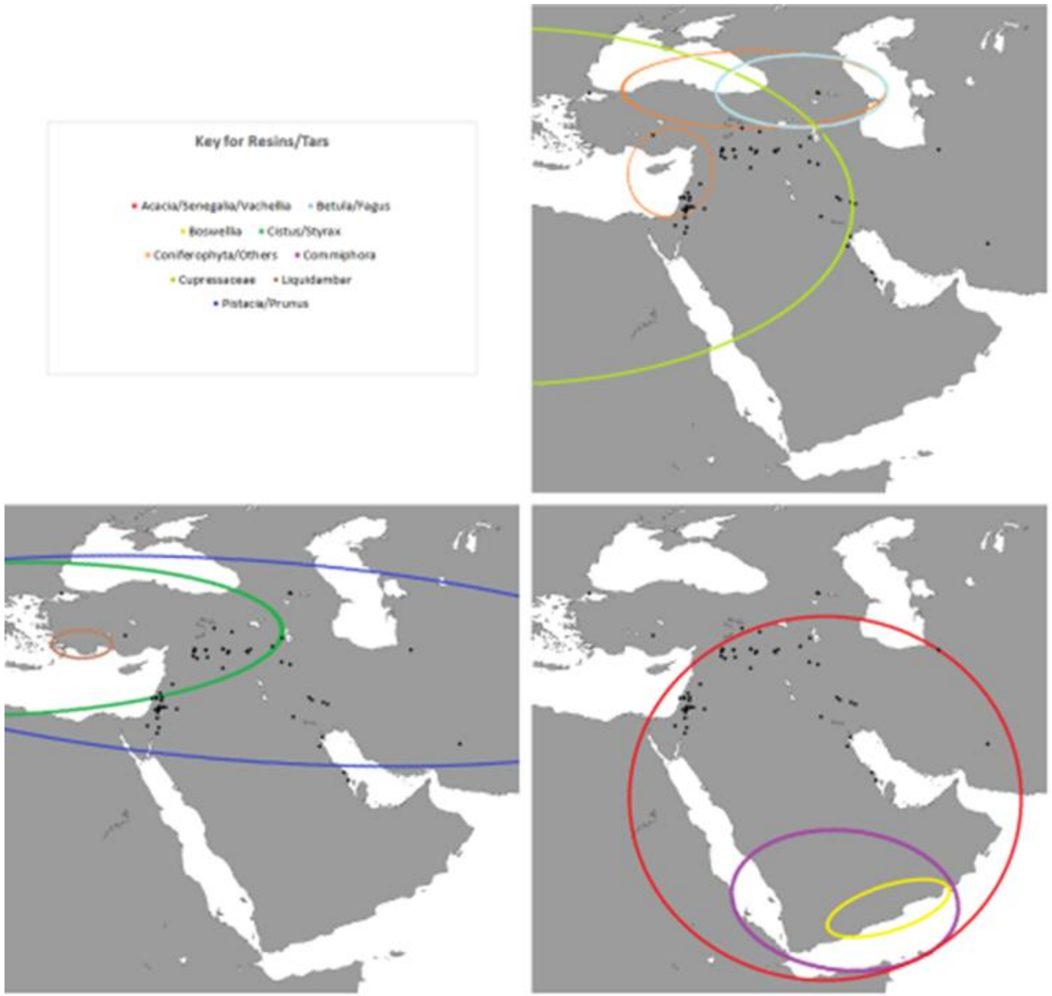


Figure 84. Approximate modern range of various gum, resin and tar producing species compared with Near Eastern sites attesting non-plaster adhesives (Bongers *et al.*, 2019; Caudullo, Welk and San-Miguel-Ayanz, 2017; Delplancke *et al.*, 2016; Civeyrel *et al.*, 2011; Lorenzo, González and Reigosa, 2010; Boivin and Fuller, 2009; Golan, 2009; Hovaneissian *et al.*, 2006; Ross, 1981).

European contexts could also potentially yield greater resin/tar diversity than currently recognised. Resin evidence largely consists of pine species, with isolated examples of Cupressaceae, fir and propolis attested. Birch species dominate tar use, with only limited utilisation of pine and beech/oak tars. However, other species – such as alders/beeches/elms/hazels/hornbeams/larches/spruces – overlap significantly and could also be exploited (Caudullo, Welk and San-Miguel-Ayanz, 2017). Limited data from Southern Europe could also conceal adhesive diversity – Cistus, Pistacia, Prunus and Styrax species occur across the Mediterranean basin, raising potential for utilisation in European contexts (Delplancke *et al.*, 2016; Civeyrel *et al.*, 2011; Golan, 2009). Use of sandarac seems very unlikely, given its poor adhesion to flint and wooden surfaces and difficulty to process for use.

Limited evidence hinders effective discussion of animal glues regionally – with significant potential for use and performance to vary depending on species availability for collagen production. Experimental test runs with cod skin and halibut bone glues significantly varied in performance compared with their trout equivalents. Greater prevalence of animal glues in European contexts can be attributed to investigation of paint binders and material from waterlogged contexts, not any specific regional differences.

By contrast, significant regional differences in plaster usage are very evident. European plasters remain largely unidentified, due to a lack of detailed chemical analysis – clay forms the majority of identified plasters, with lime plasters infrequent. Near Eastern evidence is more diverse, with lime, gypsum, clay and mud plasters attested in similar proportions – why? European evidence is poorly preserved, mostly remnants of clay daub applied to wattle structures, indicating the presence of Neolithic buildings (Diachenko *et al.*, 2021; Ammerman, Shaffer and Hartmann, 1988). By contrast, Near Eastern plasters largely derive from preserved structural remains (mudbrick, pisé) within stratified tell sites. The majority of European clay plasters (and a significant portion of unidentified plasters) are burnt, likely from ritualised house destruction, suggesting preservation solely due to firing of clay into ceramic material – potentially concealing utilisation of other plasters (Diachenko *et al.*, 2021; Gibson *et al.*, 2017; Greenfield, Greenfield and Jezik, 2014; Shaffer, 1993). This may bias the European record towards clay materials from burnt structures, with behaviour upon disintegration of unburnt wattle structures causing differential preservation. Furthermore, daub composition has not been examined in any considerable detail – with its presence merely noted, mapped/weighed to identify structures or analysed via optical microscopy to evaluate surviving plant impressions (Lityńska-Zajaç, 2016; Lityńska-Zajaç, Moskal-Del Hoyo and Nowak, 2008; Ammerman, Shafer and Hartmann, 1988). Near Eastern contexts attest regional differences in utilisation – with gypsum use almost entirely concentrated within Eastern Syria/Northwestern Iraq, whilst lime/clay/mud plasters are largely present in the Levant – possibly arising from geological factors, with soil gypsum content correlating with usage (Figure 85) (Escudero *et al.*, 2014; De Pauw *et al.*, 2008; Singer, 2007; Verheye and Boyadgiev, 1997; Buringh, 1960).

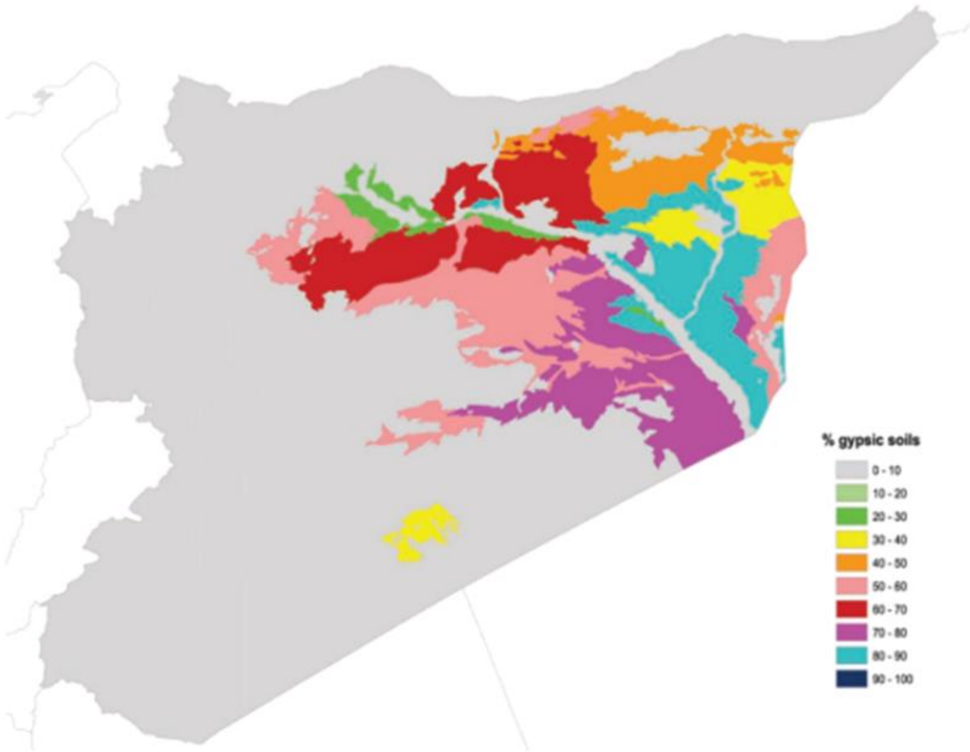


Figure 85. Gypsum content in Syrian soils (De Pauw *et al.*, 2008: Figure 3).

Adhesive uses also differ significantly by region. Application uses are more frequent in Near Eastern contexts compared with Europe, where gluing and unknown roles predominate – in the latter case, largely from greater chemical analysis of ceramics. However, despite gluing forming a smaller percentage of Near Eastern evidence, site numbers are similar. Some uses are limited entirely to Europe - in the case of burning, this results entirely from ceramic analysis not employed in Near East research contexts and chewing relates to tar adhesives absent from the Near East. Bitumen may not have been chewed due to negative health risks despite its use being attested in various ethnographic contexts (Wärmländer *et al.*, 2011; Gayton, 1948; Best, 1924). Use sub-types also differ – with Near Eastern application evidence including use in production of plastered skulls and reed-bundle statues, while repairing is more frequently attested in European gluing contexts, due to greater ceramic evidence. Plaster evidence is employed to manufacture white ware containers and haft projectile points, whereas architectural contexts dominate, when identified, in Europe. Similarly, Near Eastern use of bitumen is more diverse, with more frequent unidentified lumps of material and use in decorating plastered skulls/statues, compared with almost entirely hafting evidence in Europe. Animal glues, beeswax, resins and unidentified adhesives see little difference between regions – being utilised largely in the same roles.

Near Eastern contexts see greater aggregate use compared with Europe, alongside increased use of multiple aggregates within the same adhesive, due to greater predominance of plaster adhesives. Limited analysis of European plasters is likely responsible for this difference, as well as greater preservation of architectural elements in Near Eastern contexts. Plasticiser use, in contrast, is almost entirely limited to Europe. Limited evidence of aggregates/plasticisers in bitumen adhesives is difficult to explain, as use can limit adhesive sweating in hot conditions with bitumen flexibility observed to benefit significantly from plasticiser addition in experimental contexts (Connan *et al.*, 2005). Other element use is broadly similar between regions but differs substantially by type – Near Eastern sites attest largely plaster mixtures, possibly to add flexibility or reduce required lime content – while European sites attest substances deriving from chemical analysis of ceramic material (dairy products, plant oils and waxes) mixed with beeswax, of uncertain purpose. Greater combinations of aggregates with other elements within complex plaster mixtures is attested in Near Eastern contexts, although it is difficult to distinguish between deliberate incorporation of content versus natural occurrence.

7.1: Summary

Unlike temporal differences, significant regional differences in usage are attested. European contexts attest a wider range of adhesive types but less use variation. Tars form the most frequently attested non-architectural adhesive in Europe, whereas bitumen predominates in the Near East. Overall, the regional presence of adhesives broadly correlates with natural source material distributions – birch tars favoured in Europe, albeit possibly due to preservation issues, are absent in Near Eastern contexts, with other tar-producing materials largely at the peripheries of the context and possibly ineffective in hotter conditions. Resins – infrequently interpreted in the Near East – are widely attested across both contexts, with their absence possibly resulting from insufficient chemical analysis of material, especially ceramics. Significant differences in plaster types may result from varying analytical techniques and preservation contexts, rather than actual variation in use – although it is difficult to interpret due to limited analysis of European plaster evidence. Significant regional differences in additive use occur – with aggregates more frequent in Near Eastern contexts due to greater plaster utilisation, whilst plasticisers are largely restricted to Europe. Other elements are more broadly distributed – but vary significantly by type – with additional plasters attested from the Near East and substances detected alongside beeswax residues deriving from Europe.

8: Production of Adhesives

8.1: Tar Adhesives

With the exception of plasters, traces of Mesolithic/Neolithic adhesive production are infrequent and highly ambiguous in nature, relating almost entirely to birch bark tars. Evidence for aceramic tar production is particularly limited. Birch bark wrapped around a central clay/pebble core (Figure 87) at the Mesolithic site of Henauhof-Nord II - initially described as a fishing weight – has been reinterpreted by Pawlik (2004) as a preparation for tar production. While finds are attested from other Mesolithic sites – such as fragments of birch bark adhering to tar lumps from Huseby Klev and residue-coated pebbles from Star Carr – it is unclear whether these derive from adhesive production or processing (Kozowyk *et al.*, 2017; Kjellström *et al.*, 2010; Clark, 1954).

As a consequence, discussion of aceramic tar production remains almost entirely theoretical – based on experimental data largely concerned with Middle Palaeolithic contexts. Groom, Schenck and Pedersen (2013) demonstrate raised mounds of sand (Figure 86) covering bark rolls can provide suitably anaerobic environments for tar production, with Kozowyk *et al.* (2017) – analysing a broader range of possible methods – finding this technique consistently produced the highest tar yield. Kilns made from clay (Figure 86) can also be utilised to produce tar heavily contaminated with unprocessed bark, when sealed firmly with a layer of sand and clay (Kozowyk *et al.*, 2017; Osipowicz, 2005). Both these methods are more complex to prepare, but require less attention from the experimenter by comparison with ash mound (covering a bark roll with ash and embers) and pit roll (placing a lit bark roll in a sloped pit, allowing tar collection at its base) techniques (Figure 86) (Groom and Schenck, 2018; Kozowyk *et al.*, 2017). In particular, ash mounds require a careful balance be maintained between the ratio of ash and embers for successful tar production – necessitating careful monitoring and adjustment by the experimenter (Kozowyk *et al.*, 2017). However, Schmidt *et al.* (2019) indicate tar could also be produced relatively simply via condensation onto a cobble situated near burning bark (Figure 86), as a critique of adhesive production as an indicator of Neanderthal behavioural complexity. In response, Niekus *et al.* (2019) – among other arguments – note that use of these simpler condensation techniques would have required up to 40x more bark to produce comparable tar quantities to raised structures – a greater investment of resources for the same outcome. Different production techniques may affect the strength of resulting tars – lap shear experiments by Schmidt *et al.* (2021) indicated tar produced by condensation over an hour's timeframe had greater strength than that produced via raised structures over 3 hours, although longer (20-hour) raised structure production exhibited similar strength. It remains unclear whether better performance might promote preferential use of condensation-derived tars despite the greater material quantities required.

Figure 86. Aceramic production techniques: (A) raised mounds, (B) clay kilns, (C) pebble from the base of a sloped pit, (D) ash mounds and (E) condensation (Schmidt *et al.*, 2019: Fig. 1; Kozowyk *et al.*, 2017: Figs. 2, S1 and S12; Osipowicz, 2005: Photo 1).

These methods leave only ephemeral traces – with the notable exception of condensation or pit roll techniques, which potentially explain residues on cobbles from Star Carr and earlier Middle Palaeolithic sites such as Inden-Altdorf (Pawlik and Thissen, 2017; Clark, 1954). A range of different materials (cobbles, shells, leaves, fragments of bark) could potentially have been utilised at the base of pits or raised mounds to collect tar residues, however, apart from these cobbles, possible traces have not yet been identified (Kozowyk *et al.*, 2017). Experimental data indicates pits and raised mounds leave faint, almost imperceivable footprints which could easily be mistaken for areas of burning or shallow depressions – common in the archaeological record and not always cultural in origin (Kozowyk *et al.*, 2017; Groom, Schenck and Pedersen, 2013; Osipowicz, 2005). Detailed chemical analysis of sediments would be necessary to even confirm the presence of tar at one of these structures, let alone prove origination from production rather than other hearth-related activities. Careful sediment analysis of funnel-shaped structures at a Swedish Iron Age site led to interpretation of pine tar production – the same techniques could be applied to Mesolithic/Neolithic pits (Hjulström, Isaksson and Hennius, 2006). Some techniques are particularly ephemeral – use of ash mounds would be practically impossible to detect and the sand-rich lining of clay kilns rapidly dissolves upon exposure to rain, leaving behind only a concentration of clay and pebbles more reminiscent of a hearth than any more complex structure (Kozowyk *et al.*, 2017; Osipowicz, 2005). Even what definite evidence is attested cannot be attributed to any specific technique – bark fragments adhering to tar from Huseby Klev could derive incidentally from accidental incorporation or possibly reflect use of containers to collect liquid tar in mounds/pits (Kjellström *et al.*, 2010). Likewise, the wrapped bark coil from Henauhof-Nord II could have been involved in a wide variety of processes – with the internal core perhaps intended to hold bark in place or collect tar residues.

It remains uncertain how the development of ceramics impacted tar production – direct evidence is restricted to either thick crusts of tar located at the base/rim of vessels or tar streaks without any obvious function from various European Neolithic sites (Ergolding Fischergasse, Rheinhausen, Rudna Wielka 5 – see Figure 87) which could reflect either production, processing or storage (Rageot *et al.*, 2019; Kabaciński *et al.*, 2015; Stöckl and Westermann, 2004; Ottaway, 1992). But overall, direct evidence for use of ceramics in adhesive production is infrequent – with suggestions that production may have been conducted away from excavated sites, in forested areas closer to the bark and wood fuel required (Urem-Kotsou *et al.*, 2018; Mirabaud *et al.*, 2015; Prokeš *et al.*, 2009-2010). Several Roman-era kiln finds in mountainous parts of Andorra and various pit structures used for tar production in Viking Age Sweden support this - all located some distance from nearby settlements (Hennius, 2018; Orengo *et al.*, 2013; Hjulström, Isaksson and Hennius, 2006). Less obvious signs of production evidence may have been subsumed into other interpretative categories – such as sealing/waterproofing of vessels. Such interpretations have all too often relied on the mere presence of adhesive on ceramic material without evidence of any other use context (i.e., gluing), which may conceal production evidence. Tar residues could also be mistaken for food crusts, which appear visually similar and often require chemical analysis to distinguish them fully (Urem-Kotsou *et al.*, 2018). However, it remains unclear how such traces *could* be identified as production evidence without a more detailed understanding of how to microscopically distinguish between deliberate adhesive application for the purposes of sealing/waterproofing (potentially using brushes or heated stones) as opposed to incidental residues from tar production or other use contexts, if it is even possible to do so. As with aceramic production data, ceramic evidence does not shed much light on adhesive production techniques. Residues do not clearly reflect direct production contexts and could just as easily derive from later processing or storage, preventing detailed assessment of ceramic involvement in adhesive production. While evident that ceramics have been involved in several circumstances likely pertaining to adhesive production/processing, the extent to which their development impacted pre-existing aceramic production methodologies cannot be assessed with the current level of evidence. Additional non-ceramic evidence for adhesive production is present from the Neolithic – with lumps of bark/wood present in tar lumps from Żuławka 13 and the remains of a carbonised bark roll used in tar production attested from Palù di Livenza – both in Europe (Pietrak, 2019; Micheli *et al.*, 2018). But, as with Mesolithic evidence, this is ambiguous and cannot provide insight into specific techniques.

The best indication of specific techniques employed in Neolithic adhesive production derives from chemical analysis of tars. Differences in tar chromatograms at sites such as Chalain, Giribaldi and Makriyalos 1 have been interpreted as reflecting less standardised adhesive production involving differing production techniques, whereas less diverse tar profiles at Clairvaux VII and XIV, Ilinentsi and Podri l'Cortri have been seen to indicate less variation in production (Perthuison *et al.*, 2020; Urem-Kotsou *et al.*, 2018; Kabaciński *et al.*, 2015; Mirabaud *et al.*, 2015; Regert, 2004; Bosquet *et al.*, 2001; Binder *et al.*, 1990). Whilst this does not indicate what these techniques may have been, the absence of microporous structures and presence of fatty acids/diacids in tars from sites like Giribaldi, Rudna Wielka 5 and Tominy 6 have been interpreted as suggesting methods involving separation per descensum (aceramic/ceramic techniques involving tar separation from pyrolyzed bark, such as pit roll techniques or the two-chamber method with ceramics) producing higher quality tar (Kozowyk *et al.*, 2017; Kabaciński *et al.*, 2015; Binder *et al.*, 1990). Likewise, differences in betulin levels have been interpreted as signalling differences in tar production methods, with lower content in tar from La Rouvière seen as indicating production without separation of tar from bark – though less definitively so, given weaker correlations between betulin content and production techniques (Perthuison *et al.*, 2020; Kozowyk *et al.*, 2017). However, this indicates little about the overall role of ceramics in adhesive production, which still eludes archaeological understanding.

Figure 87. Physical evidence for adhesive production: (A) a bowl from Rheinhausen, (B) a sherd from Rudna Wielka 5 and (C) birch bark rolled around a central clay/pebble core from Henauhof-Nord II (Kabaciński *et al.*, 2015: Fig. 5; Pawlik, 2004: Fig. 19.24; Stöckl and Westermann, 2004: Fig. 4).

8.2: Other Adhesives

Evidence for the processing or production of other adhesives – excepting plasters – is scarce or absent. Most other adhesives (beeswax, bitumen, resins) derive naturally but – especially in the case of bitumen – attest evidence for processing. Thick crusts present on ceramics from Near Eastern sites like Ain as-Sayh and Göytepe have been viewed as indicating processing or storage, with bitumen-coated pebbles from Ali Kosh suggested to have been used in stirring or surface application (Alakbarov, 2015; Connan and Carter, 2007; Hole and Flannery, 1968). Evidence for beeswax or resin processing, however, is more elusive. Interpretations of resin processing are absent and only one instance of beeswax processing is suggested – traces of pure beeswax present in a vessel from the Neolithic site of Moverna Vas were interpreted due to the absence of mixed elements and poor experimental performance in waterproofing containers (Šoberl *et al.*, 2014). Some microscopic beeswax/resin traces identified via chemical analysis of ceramic materials – lacking identified uses – could derive from processing, but without clear indicators (thick adhesive crusts or streaks) this possibility cannot be assessed.

Although collagen glues – like tars and certain plasters – require direct production from animal materials, evidence of such processes is lacking in prehistoric contexts. While the perishable nature of animal glues could explain a great deal of this absence, microscopic traces of leeched collagen could potentially be detected via chemical analysis of ceramic materials. However, our ability to distinguish residues deriving from glue production against animal products used in culinary contexts can be questioned. Container use would be required in aceramic contexts to simmer collagenaceous material in water for sustained periods – with Speth (2015) noting hide bags and bark containers will not burn when filled with liquid, even when exposed directly to flame. Furthermore, as higher temperatures can negatively affect the strength of resulting collagen glues, such containers would not have needed direct fire exposure and could easily have been placed or suspended near heat sources to obtain the requisite 60-90°C necessary to leech collagen without impacting glue performance (Schellmann, 2007; Hull and Bangert, 1962). Beeswax – given its runny nature – may also have been aceramically produced in perishable containers, perfectly achievable without the presence of water to prevent burning as beeswax requires temperatures of only 60°C to liquify (Bernal *et al.*, 2005). Given the perishable nature of such containers, exceptional preservation contexts would be necessary to attest their existence, let alone use in adhesive production. Shells could possibly have been utilised in processing small volumes of beeswax (but likely not animal glues, given the larger volumes of liquid/material necessary to produce appreciable glue quantities) although no evidence of shell use in adhesive processing/production has been attested for any substance.

Evidence for plaster production is more direct and interpretable in comparison to the evidence discussed above – although still infrequent. This consists entirely of lime as opposed to gypsum or clay/mud plasters – as higher temperatures (>700°C) are required over a sustained period to calcinate limestone or other rocks, necessitating use of kiln structures (Friesem *et al.*, 2019; Toffolo *et al.,* 2017; Garfinkel, 1987). Largely originating from the Neolithic, deposits of incompletely calcinated limestone alongside burnt materials in pits/depressions at el-Khirbe and Kfar HaHoresh, as well as surface deposits of lime associated with pits/gullies and detached lumps of wall plaster at Çatalhöyük, attest immediate production contexts unseen for tars and other adhesives (Toffolo *et al.*, 2017; Goren and Goring-Morris, 2008; Arkin, 2003). A single Late Epipalaeolithic example of lime plaster production is also attested within a hearth at Hayonim (Kingery, Vandiver and Prickett, 1988; Bar-Yosef, 1983). In particular, evidence from Kfar HaHoresh (incompletely calcinated limestone associated with cobbles in several burnt depressions) closely resembles lime kilns produced experimentally (Figure 88) by Goren and Goring-Morris (2008). These experiments demonstrated kiln exposure to the elements can lead to their virtual disappearance within a decade, with near total loss of remaining quicklime, requiring use of detailed chemical/microscopic analyses to identify them in the archaeological record (Toffolo *et al.*, 2017; Goren and Goring-Morris, 2008). It's possible that a good deal of plaster production evidence has simply gone unrecognised – i.e., pits containing burnt material such as those noted at Tell Ramad by Moore (1978) could potentially represent lime kilns. This problem could be compounded by kiln reuse for other purposes – like ceramic production – which might obscure less archaeologically visible roles like plaster production. Furthermore, it has been suggested that – as with tar production – production of lime plasters could have been concentrated away from excavated sites in limestone quarries due to more immediate material access and its caustic nature, with the resulting quicklime then transported elsewhere (Wernecke, 2008; Thuesen and Gwozdz, 1982). This would explain the presence of a lime kiln at el-Khirbe, situated within a limestone quarry (Toffolo *et al.*, 2017). While it could be argued the predominance of pit-kilns is a consequence of greater preservation, with open-air kilns more likely to deteriorate completely, ethnographic evidence from Mayan contexts supports preferential use of pit-kilns (Seligson, Ruiz and Pingarrón, 2019; Toffolo *et al.*, 2017; Schreiner, 2004). They retain heat more efficiently, better stabilise wood fuel and protect against wind (Seligson, Ruiz and Pingarrón, 2019; Schreiner, 2004). Indirect evidence of plaster production is also present in both regions, consisting of thick deposits of quicklime or lime plaster at the base or rim of vessels (Gencheva, 1992; Thuesen and Gwozdz, 1982).

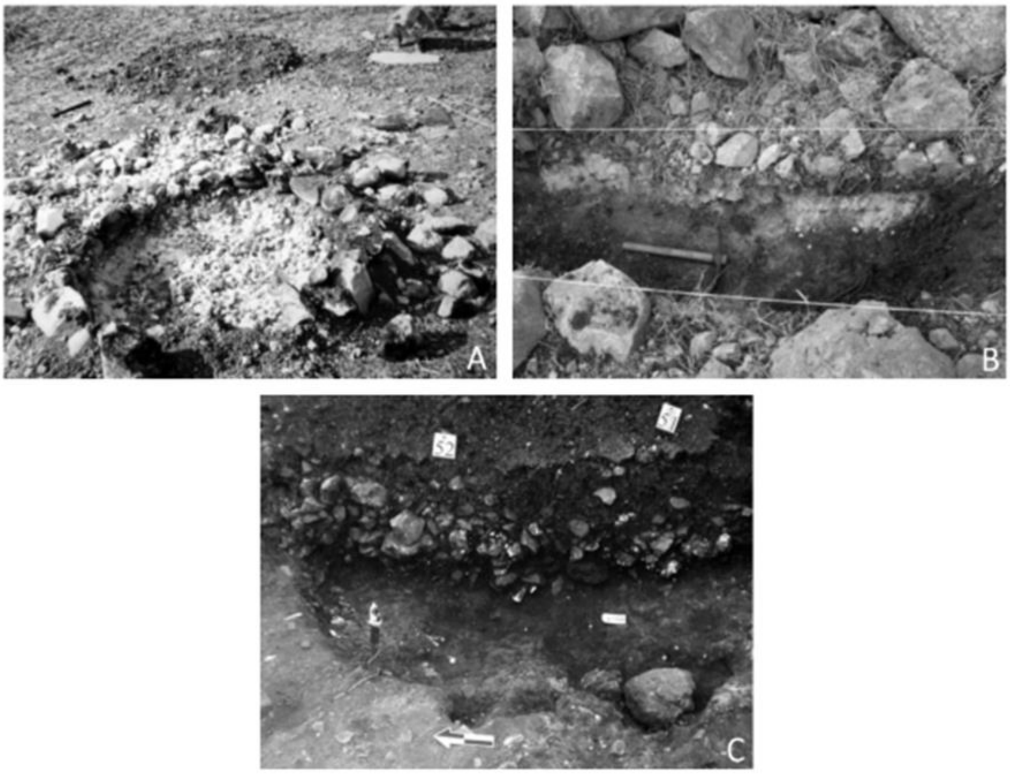


Figure 88. Experimental lime kilns (A) before and (B) after sustained weathering compared with (C) lime kiln remains from Kfar HaHoresh (Goren and Goring-Morris, 2008).

8.3: Summary

In summary, evidence for adhesive production is limited in nature, difficult to interpret and derives only from plaster and tar adhesives. Lime plaster production is far easier to assess than tar adhesives, with direct contexts of production identified. By contrast, tar production evidence is ambiguous and difficult to attribute to specific production techniques, with interpretations based largely off experimental data into technique effectiveness. The impact of ceramic development upon tar production is difficult to assess, given limited archaeological data, poor understanding of pre-existing aceramic techniques and the potential for a significant element of ceramic production evidence to result from storage, processing or other use roles rather than production *per se*.

9: Conclusion

This thesis examined whether differences in adhesive usage and production as a result of the Neolithic transition could be interpreted, utilising archaeological site databases alongside experimental data as a critiquing factor. In summary, the impact of Neolithisation is difficult to evaluate. Excepting plasters, strong continuity is evidenced from Middle Palaeolithic times – although taphonomic issues, preservation of microscopic residues on ceramic surfaces and analytical techniques employed might significantly bias archaeological data towards more robust adhesives, such as tars/bitumen. However, these also demonstrate greater performance, raising the likelihood of preferential selection. Production evidence is limited and difficult to interpret, with only lime plaster evidence clear and unambiguous. Consequently, this thesis was only able to *partly* resolve its principal aim, with additional research required to evaluate ambiguities in the archaeological record – assessing the impact of preservation and adhesive working properties in greater detail. Specific suggestions for further research are outlined further below.

Substantial continuity appears present in adhesive usage across Late Epipalaeolithic/Mesolithic and Neolithic contexts in both regions - birch tars and bitumen continue their preferential utilisation in Europe and the Near East respectively. Experimental data, both in this study and others, demonstrates both to be the most effective adhesives for high stress tasks, with innate water-resistant qualities. However, it is difficult to explain the overwhelming predominance of birch compared to pine tars, which experimental evidence shows exhibits comparable strength – this may result from taphonomic issues, lower yields and/or greater temperature sensitivity. How taphonomic factors impact archaeological adhesives more broadly remains uncertain – but they clearly play a significant role. The near total absence of animal glues, despite their strength, is likely attributable to poor preservation. With resins, gums and other adhesives, this remains more unclear. Experimental data indicates they possess less adhesive strength than tars/bitumen, suffer from water exposure without additives, and face preservation issues - but some element of resin use, particularly in Near Eastern contexts, may be subsumed into tar/bitumen evidence due to insufficient chemical analysis. Though infrequently employed, additive usage remains comparable across both periods, with increases in aggregate and other element content in Neolithic contexts attributable to increased use of both plaster and ceramics.

Adhesive use broadly corresponds with source material distribution across both contexts – the near absence of bitumen in European contexts can be attributed to a limited distribution, exacerbated by lack of evidence from Northwestern Germany, Italy and Romania. In the Near East, birch species are absent outside the Caucasus, which attests little adhesive evidence, and tar derived from Levantine conifer species would have fared poorly in hot temperatures and preserved less well. However, tar, beeswax and resin absence from Near Eastern contexts may also arise from analytical techniques employed – with under 50% of bitumen identified via chemical analysis – and preservation contexts, with focus on aceramic PPN contexts minimising analysis of Later Neolithic ceramic material which might better preserve adhesive traces. Regional differences in plaster use may also be attributed to analytical techniques, with insufficient European plaster analysis – and probable poor preservation, hindering comparisons with Near Eastern data from well-stratified tell sites. However, concentration of gypsum plasters within Eastern Syria can be squarely attributed to geological factors.

However, some clear changes in the archaeological record are distinguishable. Plaster use increases significantly in Neolithic contexts, with the emergence of more permanent structures necessitating its use in sealing out the elements and, in Near Eastern contexts, symbolic roles plastering human skulls and anthropomorphic statues. But this remains the only unambiguous change, resulting from actual use differences, upon the Neolithic transition. Increased beeswax quantities and changing resin uses can be broadly attributed to differing preservation contexts, with ceramic materials providing a more stable preservation surface for microscopic adhesive traces. While their presence could represent actual shifts in usage, this cannot be determined due to the nature of the aceramic archaeological record. Plaster utilisation and trace detection of beeswax/resins lead to increasing interpretation of application and unknown uses for adhesives in Neolithic contexts, whilst gluing dominates the Late Epipalaeolithic/Mesolithic.

Production evidence is exceptionally difficult to identify. Excepting lime plaster, this relies heavily on experimental data. Whilst considerable evidence may remain unexcavated due to likely production outside settlement contexts, clear evidence of tar production/processing is evident in both aceramic and ceramic contexts. However, distinguishing between production/processing is difficult and specific production techniques harder still. The impact of ceramic development on tar production is unclear – whilst clearly employed in contexts relating to production/processing, the extent of utilisation compared with pre-existing aceramic techniques is unclear due to limited evidence and poor understanding of aceramic production methods. In contrast, direct contexts of lime production are identifiable, albeit infrequent.

9.1: Further Research

Further research is needed to adequately compare Late Epipalaeolithic/Mesolithic and Neolithic adhesive usage – particularly in the Near East, where the limited amount of Late Epipalaeolithic evidence (11 sites) renders anything beyond the broadest comparisons impossible. Geographical restriction of sites may also impact wider applicability of evidence across a region – in Europe, Mesolithic and Neolithic data clusters separately, with little overlap. Differing environmental conditions could therefore impact the validity of temporal comparisons. Furthermore, lack of substantial data from Southern Europe and areas of the Near East other than the Fertile Crescent could conceal greater adhesive variation.

The importance of chemical analysis for adhesive identification is clear, given potential for misidentification when visually examined, as demonstrated by Nahal Hemar. Increased use is required, particularly when assessing bitumen and plasters, where under half are chemically examined. Experimental results highlight potential for adhesives infrequently attested or absent archaeologically – such as Chios mastic and labdanum – to be identified in the future. Assessment of adhesive preservation across a broader range of adhesives may be useful in assessing the validity of the archaeological record, such as the absence of the above adhesives. Furthermore, assessment of adhesive properties (strength, water resistance, etc.) might further support the results of this study – most archaeological adhesive experiments concentrate on assessing properties of a narrow range of archaeologically attested adhesives, rather than considering what is not present but might also have been utilised in prehistory. Properties of animal glues, resins and tars might vary according to species – as in the case of birch and pine tars – here, insight into differing performance could highlight preferential adhesive selection. Further analysis of beeswax as a sealant would prove useful, as it has been interpreted as being used in vessel waterproofing but appears ineffective when exposed to water over longer periods.

A widespread lack of additives, particularly in resins, contradicts experimental evidence showing aggregate/plasticiser content dramatically alters adhesive performance – positively or negatively influencing strength and waterproofing many soluble adhesives. Charcoal or ash incorporation could provide additional strength for very little effort compared with gathering beeswax or other incorporated minerals, so the minimal presence of even these is difficult to explain – many chemically examined resin/tar adhesives lack additive content. Clearly, further research is required to evaluate preservation of aggregate/plasticiser content in the archaeological record.

Production evidence is often difficult to archaeologically distinguish – particularly on ceramic material, where traces could be confused with deliberate application for sealing, storage or later processing. Comparison with experimental production and application traces might assist in further distinguishing these. Detection of immediate tar production contexts could be possible – as in later Roman and Viking research, where chemical analysis of pit feature sediments revealed tar signatures. Application of these techniques in Mesolithic/Neolithic contexts could allow for greater consideration of specific production methods. Greater analysis could also be made of the limited aceramic production traces attested – such as preserved bark rolls from Henauhof-Nord II and Palù di Livenza, not examined in any considerable detail.

Archaeological terminology often describes adhesive substances poorly – use of terms like pitch, resin and tar interchangeably and to refer to completely unidentified adhesives is confusing, inconsistent between publications and hinders interpretation, particularly at broad scales evaluating many sites. To avoid potential misidentification, adhesives should be referred to in general descriptive terms when unidentified, with specific identifications only tentatively suggested without more detailed analysis.

The results of this thesis could be expanded upon in various ways. More precise testing measures – i.e., lap shear tests – could be utilised to allow greater comparability with previous experimental researches. Ethnographic data could be employed to critique the archaeological record, examining usage and production of adhesives by modern societies, particularly differences between hunter-gatherer and agricultural groups and use of additives. Most promisingly, museum collections could prove a fertile source of adhesive evidence hitherto unrecognised, given the great number of lithics/potsherds present and successful detection of resin traces by Bradtmöller *et al.* (2016) on Upper Palaeolithic lithics held in storage for many decades.

A1: Archaeological Database

Name	Region	Country	Latitude	Longitude	Period	Industry	Upper Date Limit (BP)	Lower Date Limit (BP)	Upper Date Limit (BC)	Lower Date Limit (BC)
Abu Gosh	Western Asia	Israel	31°48'22"N	35°06'37"E	Neolithic	PPNB	9,500 BP	8,000 BP	N	N
Abu Hureyra	Western Asia	Syria	35°51'58"N	38°24'00"E	Neolithic	PPNA; PPNB; PPNC	10,600 BP	7,500 BP	N	N
Adh Dhaman	Western Asia	Jordan	30°21'42"N	35°26'54"E	Neolithic	PPNB	N	N	N	N
Ageröd I	Northern Europe	Sweden	55°56'55"N	13°22'26"E	Mesolithic	Maglemose/ Kongemose	8,700 BP	8,200 BP	N	N
Ain as-Sayh	Western Asia	Saudi Arabia	26°13'17"N	50°08'53"E	Neolithic	‘Ubaid	N	N	4,500 BC	4,000 BC
Ain Ghazal	Western Asia	Jordan	31°59'17"N	35°58'34"E	Neolithic	PPNB; PPNC; Yarmoukian	N	N	8,500 BC	5,500 BC
Ain Mallaha	Western Asia	Israel	33°06'29"N	35°33'59"E	Late Epipalaeolithic	Natufian	14,592 BP	10,200 BP	N	N
Ais Giorkis	Western Asia	Cyprus	34°54'00"N	32°34'35"E	Neolithic	PPNB	N	N	7,960 BC	7,180 BC
Ajdovska Jama	Southern Europe	Slovenia	45°54'00"N	15°24'00"E	Neolithic	N	N	N	4,340 BC	4,235 BC
Akali	Eastern Europe	Estonia	58°24'17"N	27°10'02"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC

Ali Kosh	Western Asia	Iran	32°33'28"N	47°19'30"E	Neolithic	N	N	N	9,950 BC	5,410 BC
Alsónyék	Eastern Europe	Hungary	46°12'41"N	18°43'22"E	Neolithic	Starčevo–Körös–Criş	N	N	5,805 BC	5,475 BC
Altscherbitz	Western Europe	Germany	51°23'34"N	12°13'59"E	Neolithic	Linear Pottery	N	N	5,400 BC	5,300 BC
Am Wiesenberg	Western Europe	Germany	48°37'12"N	10°25'07"E	Neolithic	Linear Pottery	N	N	5,000 BC	4,500 BC
Apsalos	Southern Europe	Greece	40°53'32"N	22°03'28"E	Neolithic	N	N	N	6,020 BC	5,564 BC
Arbon-Bleiche 3	Western Europe	Switzerland	47°30'14"N	09°25'42"E	Neolithic	Pfyn/Horgen	N	N	3,384 BC	3,370 BC
Argissa Magoula	Southern Europe	Greece	39°38'11"N	22°21'10"E	Neolithic	Early Neolithic; Pre-Sesklo; Proto-Sesklo; Sesklo	N	N	*6,450 BC*	5,500 BC
Aşaği Pinar	Western Asia	Turkey	41°43'17"N	27°13'33"E	Neolithic	N	N	N	6,400 BC	4,600 BC
Asaviec 2	Eastern Europe	Belarus	54°54'59"N	29°32'42"E	Neolithic	Usviaty; Northern belarusian	4,420 BP	3,290 BP	N	N
Aşıklı Höyük	Western Asia	Turkey	38°20'56"N	34°13'48"E	Neolithic	ECA II	N	N	8,200 BC	7,400 BC
Atlit-Yam	Western Asia	Israel	32°42′39″ N	34°56′07″E	Neolithic	PPNC	9,250 BP	7,970 BP	N	N
Aukštumala	Eastern Europe	Lithuania	55°23'15"N	21°24'40"E	Mesolithic	N	N	N	N	N

Auriac	Western Europe	France	43°11'12"N	02°20'07"E	Neolithic	Chasséen	N	N	3,500 BC	3,500 BC
Avgi	Southern Europe	Greece	40°48'60" N	23°18'56"E	Neolithic	N	N	N	5,700 BC	4,500 BC
Azraq 18	Western Asia	Jordan	31°50'18"N	36°50'10"E	Late Epipalaeolithic	Natufian	14,000 BP	13,000 BP	N	N
Baaz Rockshelter	Western Asia	Syria	33°49'08"N	36°30'46"E	Late Epipalaeolithic	Natufian	N	N	10,464 BC	10,124 BC
Bad Buchau-Bachwissen I	Western Europe	Germany	48°03'57"N	09°36'18"E	Neolithic	Schussenried	N	N	4,200 BC	3,700 BC
Ba'ja	Western Asia	Jordan	30°24'48"N	35°27'39"E	Neolithic	PPNB	N	N	8,800 BC	6,500 BC
Bâlgarčevo	Eastern Europe	Bulgaria	41°51'58"N	22°56'19"E	Neolithic	N	N	N	5,650 BC	4,780 BC
Ballintaggart	Northern Europe	United Kingdom	54°17'57"N	06°17'58"W	Neolithic	N	N	N	2,880 BC	2,230 BC
Barmose I	Northern Europe	Denmark	55°02'46"N	11°53'13"E	Mesolithic	Maglemose	9,460 BP	8,840 BP	N	N
Bastuloken	Northern Europe	Sweden	63°40'22"N	16°24'07"E	Neolithic	N	N	N	2,575 BC	1,750 BC
Bazel-Sluis	Western Europe	Belgium	51°08'06"N	04°19'22"E	Mesolithic	N	N	N	4,318 BC	3,797 BC
Beaurieux	Western Europe	France	49°23'24"N	03°43'30"E	Neolithic	Michelsberg	N	N	4,500 BC	3,500 BC

Beidha	Western Asia	Jordan	30°22'15"N	35°26'52"E	Neolithic	PPNA; PPNB	N	N	7,200 BC	6,500 BC
Beisamoun	Western Asia	Israel	33°05'39"N	35°34'59"E	Neolithic	PPNB; PPNC	N	N	7,300 BC	6,200 BC
Belitsi Magoula	Southern Europe	Greece	39°16'27"N	22°46'02"E	Neolithic	N	N	N	6,000 BC	4,500 BC
Bellevue	Western Europe	France	45°57'30"N	00°13'06"E	Neolithic	Matignons	N	N	3,600 BC	3,000 BC
Bercy	Western Europe	France	48°50'09"N	02°22'54"E	Neolithic	Chasséen	N	N	4,250 BC	2,500 BC
Bestansur	Western Asia	Iraq	35°22'36"N	45°38'44"E	Neolithic	N	N	N	7,600 BC	7,055 BC
Bischoffsheim	Western Europe	France	48°29'13"N	07°29'22"E	Neolithic	Linear Pottery	N	N	5,208 BC	5,002 BC
Blagotin	Southern Europe	Serbia	43°43'03"N	21°05'54"E	Neolithic	Starčevo–Körös–Criş	N	N	6,230 BC	5,990 BC
Bökeberg III	Northern Europe	Sweden	55°31'56"N	13°15'39"E	Mesolithic	Kongemose/ Ertebølle	N	N	5,560 BC	4,680 BC
Borđoš	Southern Europe	Serbia	45°31'57"N	20°06'47"E	Neolithic	N	N	N	5,025 BC	4,950 BC
Božina Peskara	Southern Europe	Serbia	45°25'14"N	20°18'54"E	Neolithic	Tisza	N	N	4,900 BC	4,400 BC
Brunn am Gebirge	Western Europe	Austria	48°06'00" N	16°18'00"E	Neolithic	Starčevo–Körös–Criş	N	N	5,650 BC	5,100 BC

Bucşani	Eastern Europe	Romania	44°22'22"N	25°39'27"E	Neolithic	Eneolithic	N	N	4283 BC	4,077 BC
Burgan Hill	Western Asia	Kuwait	28°55'00"N	47°55'00"E	Neolithic	‘Ubaid	N	N	5,300 BC	4,800 BC
Byblos	Western Asia	Lebanon	34°07′25″ N	35°39′04″E	Neolithic	PPNB; Jericho IX; Jericho VIII	N	N	8,800 BC	4,500 BC
Bylany	Eastern Europe	Czechia	49°56'09"N	15°14'03"E	Neolithic	Linear Pottery	N	N	5,160 BC	5,100 BC
Caochanan Ruadha	Northern Europe	United Kingdom	56°53'50"N	03°45'01" W	Mesolithic	N	8,164 BP	7,958 BP	N	N
Casa Montero	Southern Europe	Spain	40°24'15"N	03°31'35"W	Neolithic	N	N	N	5,350 BC	5,220 BC
Çatalhöyük	Western Asia	Turkey	37°39'57"N	32°49'37"E	Neolithic	N	N	N	7,400 BC	6,000 BC
Catignano	Southern Europe	Italy	42°20'43"N	13°56'43"E	Neolithic	N	N	N	5,640 BC	4,910 BC
Çayönü Tepesi	Western Asia	Turkey	38°13'05"N	39°43'32"E	Neolithic	Pottery Neolithic	N	N	6,500 BC	6,000 BC
Chageh Sefid	Western Asia	Iran	32°44'47"N	47°07'44"E	Neolithic	Mohammad Jaffar	N	N	7,688 BC	7,000 BC
Chalain	Western Europe	France	46°42'00"N	05°48'00"E	Neolithic	Clairvaux; Horgen	N	N	3,200 BC	2,950 BC
Cham-Eslen	Western Europe	Switzerland	47°10'26"N	08°27'19"E	Neolithic	Lengyel	N	N	4,350 BC	3,975 BC

Champ-Durand	Western Europe	France	46°24'51"N	00°39'31" W	Neolithic	N	N	N	3,400 BC	3,000 BC
Chassey-le-Camp	Western Europe	France	46°54'00"N	04°42'00"E	Neolithic	Chasséen	N	N	4,500 BC	4,000 BC
Chełmiczki 10	Eastern Europe	Poland	52°54'40"N	18°13'34"E	Neolithic	Linear Pottery	4,480 BP	4,380 BP	N	N
Cheviot Quarry	Northern Europe	United Kingdom	55°35'11"N	02°05'17"W	Neolithic	N	N	N	3,900 BC	2,400 BC
Chevroux	Western Europe	Switzerland	46°53'24"N	06°53'52"E	Neolithic	Horgen; Cortaillod; Lüscherz; Auvenier-Cordé	N	N	4,300 BC	2,427 BC
Chogha Mish	Southern Asia	Iran	32°12'33"N	48°32'46"E	Neolithic	N	N	N	6,000 BC	6,000 BC
Clairvaux VII	Western Europe	France	46°33'35"N	05°44'58"E	Neolithic	Néolithique Moyen Bourguignon	N	N	4,431 BC	3,532 BC
Clairvaux XIV	Western Europe	France	46°33'36"N	05°45'08"E	Neolithic	Néolithique Moyen Bourguignon	N	N	4,039 BC	3,739 BC
Claish Farm	Northern Europe	United Kingdom	56°14'01"N	04°11'56"W	Neolithic	N	N	N	3,800 BC	3,500 BC
Clonava I	Northern Europe	Ireland	53°39'50"N	07°24'24" W	Mesolithic	N	N	N	4,620 BC	4,040 BC

Colle Cera	Southern Europe	Italy	42°26'46"N	14°00'37"E	Neolithic	N	N	N	5,290 BC	4,910 BC
Colmar	Western Europe	France	48°02'50"N	07°19'31"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Concise-sous-Colachoz	Western Europe	Switzerland	46°50'50"N	06°43'03"E	Neolithic	Cortaillod	N	N	3,900 BC	3,500 BC
Corongiu	Southern Europe	Italy	39°01'18"N	08°24'08"E	Neolithic	N	N	N	N	N
Cortaillod	Western Europe	Switzerland	46°56'25"N	06°51'14"E	Neolithic	Cortaillod	N	N	*3,900 BC*	*3,500 BC*
Csárdaszállás 8	Eastern Europe	Hungary	46°51'52"N	20°56'11"E	Neolithic	N	N	N	5,000 BC	5,000 BC
Cueva de El Toro	Southern Europe	Spain	36°57'10"N	04°32'18" W	Neolithic	Early Neolithic	N	N	5,280 BC	4,780 BC
Daktariškė 5	Northern Europe	Lithuania	55°47'57"N	22°23'11"E	Mesolithic	Kongemose; Narva	N	N	6,150 BC	2,885 BC
Danilo Bitinj	Southern Europe	Croatia	43°43'34"N	16°05'34"E	Neolithic	N	N	N	5,300 BC	5,100 BC
Defensola A	Southern Europe	Italy	41°54'18"N	16°08'16"E	Neolithic	N	7,070 BP	6,600 BP	N	N
Demirköy Höyük	Western Asia	Turkey	37°57'51"N	41°07'26"E	Neolithic	Pottery Neolithic	N	N	8,100 BC	8,100 BC
Devèze-Sud	Western Europe	France	43°21'06"N	03°19'16"E	Neolithic	Chasséen	N	N	4,455 BC	4,327 BC

Dikili Tash	Southern Europe	Greece	41°00'37"N	24°18'30"E	Neolithic	N	N	N	5,800 BC	4,900 BC
Divostin	Southern Europe	Serbia	44°01'26"N	20°50'03"E	Neolithic	Vinča	N	N	4,900 BC	4,650 BC
Dja'de-el-Mughara	Western Asia	Syria	36°36'58"N	38°12'58"E	Neolithic	PPNB	N	N	8,800 BC	8,290 BC
Dobroń	Eastern Europe	Poland	51°38'18"N	19°14'43"E	Neolithic	Funnel Beaker	N	N	4,300 BC	2,800 BC
Dobroslavtsi	Eastern Europe	Bulgaria	42°50'20"N	23°16'54"E	Neolithic	Early Neolithic	N	N	6,200 BC	5,500 BC
Dombate	Southern Europe	Spain	43°11'25"N	08°58'06" W	Neolithic	N	N	N	3,011 BC	2,586 BC
Domuztepe	Western Asia	Turkey	37°19'16"N	37°02'09"E	Neolithic	Halafian	N	N	5,800 BC	5,450 BC
Dorstone Hill	Northern Europe	United Kingdom	52°04'29"N	02°59'09" W	Neolithic	N	N	N	3,900 BC	3,850 BC
Dosariyah	Western Asia	Saudi Arabia	26°52'34"N	49°49'04"E	Neolithic	‘Ubaid	N	N	5,000 BC	4,500 BC
Drakaina Cave	Southern Europe	Greece	38°08'60" N	20°46'11"E	Neolithic	N	N	N	5,400 BC	4,800 BC
Dreniai	Northern Europe	Lithuania	55°45'47"N	22°23'37"E	Mesolithic	Kongemose	N	N	6,150 BC	5,700 BC
Drenovac	Southern Europe	Serbia	43°46'54"N	21°26'21"E	Neolithic	Vinča	N	N	5,300 BC	4,500 BC

Dubovo-Košno	Southern Europe	Croatia	45°06'26"N	18°41'08"E	Neolithic	Sopot	N	N	5,620 BC	4,990 BC
Dudeştii Vechi	Eastern Europe	Romania	46°03'48"N	20°28'37"E	Neolithic	N	N	N	5,990 BC	5,560 BC
Durrington Walls	Northern Europe	United Kingdom	51°11'33"N	01°47'15"W	Neolithic	Grooved Ware	N	N	2,860 BC	2,460 BC
Duvensee	Western Europe	Germany	53°42'11"N	10°34'16"E	Mesolithic	N	11,080 BP	10,290 BP	N	N
Dværgebakke I	Northern Europe	Denmark	56°10'37"N	09°20'45"E	Mesolithic	Kongemose	N	N	9,180 BC	7,830 BC
Dvoinaya Cave	Eastern Europe	Russia	44°16'07"N	40°24'44"E	Mesolithic	N	11,800 BP	8,300 BP	N	N
Ecsegfalva 23	Eastern Europe	Hungary	47°08'51"N	20°55'29"E	Neolithic	Starčevo–Körös–Criş	N	N	5,800 BC	5,700 BC
Egemarke	Western Europe	Netherlands	55°44'12"N	11°21'25"E	Mesolithic	N	N	N	N	N
Egolzwil 3	Western Europe	Switzerland	47°10'60"N	08°01'04"E	Neolithic	Egolzwil; Cortaillod	N	N	4,280 BC	4,250 BC
Eireira	Southern Europe	Portugal	41°47'34"N	08°52'02" W	Neolithic	N	N	N	5,000 BC	2,000 BC
el-Hemmeh	Western Asia	Jordan	30°58'00" N	35°43'52"E	Neolithic	PPNB; PPNC	N	N	7,830 BC	6,060 BC
el-Khirbe	Western Asia	Israel	32°45'34"N	35°01'53"E	Neolithic	PPNB	N	N	10,590 BC	10,200 BC

el-Kum	Western Asia	Palestine	31°32'05"N	34°57'59"E	Neolithic	PPNA	N	N	N	N
Ensisheim	Western Europe	France	47°51'57"N	07°20'60"E	Neolithic	Linear Pottery	N	N	5,466 BC	5,056 BC
Ergolding Fischergasse	Western Europe	Germany	48°37'29"N	12°15'56"E	Neolithic	Altheim	N	N	3,700 BC	3,340 BC
Eton Rowing Lake	Northern Europe	United Kingdom	51°29'29"N	00°39'56" W	Neolithic	N	N	N	4,000 BC	2,500 BC
Foeni-Sălaş	Eastern Europe	Romania	45°32'02"N	20°52'27"E	Neolithic	Starčevo–Körös–Criş	N	N	6,060 BC	5,500 BC
Font-Juvénal	Western Europe	France	43°18'00"N	02°18'00"E	Neolithic	N	6,500 BP	4,300 BP	N	N
Fornace Capuccini	Southern Europe	Italy	44°17'12"N	11°52'52"E	Neolithic	Impressed Ware	N	N	5,500 BC	5,000 BC
Friedberg B3a Km 19	Western Europe	Germany	50°21'03"N	08°45'11"E	Neolithic	Linear Pottery	N	N	5,100 BC	4,900 BC
Friesack	Western Europe	Germany	52°43'59"N	12°34'59"E	Mesolithic	N	9,700 BP	9,000 BP	N	N
Ftélia	Southern Europe	Greece	37°29'34"N	25°24'01"E	Neolithic	N	N	N	N	N
Füzesabony-Gubakút	Eastern Europe	Hungary	47°43'48"N	20°23'09"E	Neolithic	Alföld Linear Pottery	N	N	5,443 BC	4,857 BC
Ganj Dareh Tepe	Southern Asia	Iran	34°16'20"N	47°28'33"E	Neolithic	N	N	N	10,732 BC	9,140 BC

Gazel	Western Europe	France	43°19'32"N	02°25'18"E	Neolithic	Cardium	N	N	6,140 BC	5,350 BC
Gesher	Western Asia	Israel	32°36'10"N	35°33'20"E	Neolithic	PPNA	N	N	9,300 BC	9,300 BC
Ghwair I	Western Asia	Jordan	30°35'37"N	35°33'33"E	Neolithic	PPNB	N	N	8,484 BC	7,033 BC
Gilgal I	Western Asia	Palestine	32°01'57"N	35°28'45"E	Neolithic	PPNA	11,750 BP	10,930 BP	N	N
Gilgal II	Western Asia	Palestine	32°01'54"N	35°28'44"E	Late Epipalaeolithic	Natufian	12,400 BP	11,300 BP	N	N
Giribaldi	Western Europe	France	43°42'25"N	07°16'36"E	Neolithic	Proto-Chasséen; Chasséen	N	N	4,700 BC	4,000 BC
Girmeler Cave	Western Asia	Turkey	36°35'21"N	29°22'46"E	Neolithic	N	N	N	8,200 BC	7,900 BC
Göbekli Tepe	Western Asia	Turkey	37°13'23"N	38°55'21"E	Neolithic	PPNA; PPNB	N	N	9,600 BC	8,200 BC
Gorhambury	Northern Europe	United Kingdom	51°45'13"N	00°22'58" W	Neolithic	N	N	N	3,696 BC	3,389 BC
Gorjani-Kremenjača	Southern Europe	Croatia	45°23'18"N	18°23'01"E	Neolithic	Sopot	N	N	5,200 BC	4,300 BC
Gorzsa	Eastern Europe	Hungary	46°22'11"N	20°25'29"E	Neolithic	Tisza	N	N	4,846 BC	4,495 BC
Göytepe	Western Asia	Azerbaijan	40°58'12"N	45°42'18"E	Neolithic	Shulaveri-Shomu	N	N	5,650 BC	5,460 BC

Gradište	Southern Europe	Serbia	45°51'20"N	20°22'06"E	Neolithic	Vinča; Tisza	N	N	6,000 BC	4,500 BC
Grande Rivoire	Western Europe	France	45°13'18"N	05°38'41"E	Mesolithic	Sauvterrian	N	N	7,974 BC	7,056 BC
Gribaša 4	Northern Europe	Lithuania	54°02'34"N	24°43'36"E	Mesolithic	Kongemose	N	N	6,150 BC	5,700 BC
Grotta dei Cervi	Southern Europe	Italy	40°04'57"N	18°29'04"E	Neolithic	N	N	N	6,000 BC	2,300 BC
Grotta dei Piccioni	Southern Europe	Italy	42°13'09"N	13°57'39"E	Neolithic	N	N	N	N	N
Grube-Rosenhof	Western Europe	Germany	54°13'25"N	11°01'42"E	Mesolithic	Ertebølle	N	N	4,600 BC	4,600 BC
Grumăzești	Eastern Europe	Romania	47°09'16"N	26°24'38"E	Neolithic	N	N	N	4,612 BC	4,503 BC
Gusir Höyük	Western Asia	Turkey	37°43'38"N	41°49'16"E	Neolithic	PPNA	11,400 BP	10,300 BP	N	N
H3	Western Asia	Kuwait	29°38'08"N	48°08'17"E	Neolithic	'Ubaid	N	N	5,300 BC	4,800 BC
Hacı Elamxanlı Tepe	Western Asia	Azerbaijan	40°58'47"N	45°42'07"E	Neolithic	Šomutepe-Šulaveri	N	N	6,015 BC	5,733 BC
Hacilar	Western Asia	Turkey	37°35'04"N	30°05'05"E	Neolithic	N	N	N	7,400 BC	5,600 BC
Hagoshrim IV	Western Asia	Israel	33°13'15"N	35°37'25"E	Neolithic	Jericho IX	6,845 BP	6,605 BP	N	N

Hajji Firuz Tepe	Southern Asia	Iran	37°27'18"N	44°59'60"E	Neolithic	N	N	N	5,400 BC	5,000 BC
Hama M	Western Asia	Syria	35°08'11"N	36°44'58"E	Neolithic	N	N	N	6,000 BC	5,000 BC
Hanaton	Western Asia	Israel	32°46'29"N	35°14'17"E	Neolithic	PPNB; Wadi Rabah	N	N	7,500 BC	4,500 BC
Hangest-sur-Somme	Western Europe	France	49°58'50"N	02°03'51"E	Mesolithic	Beuronian	N	N	8,500 BC	7,500 BC
Har Harif	Western Asia	Israel	30°29'37"N	34°33'26"E	Neolithic	N	N	N	5,295 BC	4,545 BC
Hauslabjoch	Southern Europe	Italy	46°46'52"N	10°50'18"E	Neolithic	N	N	N	3,370 BC	3,100 BC
Hayonim	Western Asia	Israel	32°55'12"N	35°13'06"E	Late Epipalaeolithic	Natufian	N	N	10,400 BC	10,000 BC
Heilbronn-Klingenberg	Western Europe	Germany	49°07'04"N	09°09'20"E	Neolithic	Michelsberg	N	N	4,000 BC	3,800 BC
Henauhof-Nord II	Western Europe	Germany	48°02'30" N	09°37'36"E	Mesolithic	N	N	N	5,500 BC	5,000 BC
Hilazon Tachtit	Western Asia	Israel	32°53'48"N	35°16'07"E	Late Epipalaeolithic	Natufian	12,400 BP	12,000 BP	N	N
Horákov	Eastern Europe	Czechia	49°14'02"N	16°44'57"E	Neolithic	Lengyel	N	N	5,000 BC	3,400 BC
Hornstaad-Hörnle I	Western Europe	Germany	47°41'27"N	09°00'03"E	Neolithic	N	N	N	3,919 BC	3,902 BC

Horvat Galil	Western Asia	Israel	33°02'30"N	35°14'53"E	Neolithic	PPNB	9,410 BP	6,900 BP	N	N
Hovland 3	Northern Europe	Norway	59°05'02"N	10°02'46"E	Mesolithic	N	N	N	7,680 BC	7,200 BC
Hrdlovka	Eastern Europe	Czechia	50°35'22"N	13°42'59"E	Neolithic	Linear Pottery; Stroked Pottery	N	N	4,596 BC	3,855 BC
Huddunge 230	Northern Europe	Sweden	60°03'01"N	16°59'12"E	Mesolithic	N	N	N	5,600 BC	5,600 BC
Huseby Klev	Northern Europe	Sweden	58°10'13"N	11°29'11"E	Mesolithic	Maglemose	N	N	8,000 BC	8,000 BC
Ilindentsi	Eastern Europe	Bulgaria	41°40'24"N	23°17'20"E	Neolithic	N	N	N	5,650 BC	5,450 BC
Inchture	Northern Europe	United Kingdom	56°26'52"N	03°10'12"W	Neolithic	N	N	N	3,640 BC	3,360 BC
Iraq ed-Dubb	Western Asia	Jordan	32°21'36"N	35°43'48"E	Neolithic	PPNA	11,700 BP	10,500 BP	N	N
Ispiluncas	Southern Europe	Italy	40°09'30" N	08°54'09"E	Neolithic	N	N	N	N	N
Ivanovskoye 7	Eastern Europe	Russia	57°19'36"N	38°40'30"E	Mesolithic	Butovo	N	N	7,810 BC	5,180 BC
Jarmo	Western Asia	Iraq	35°32'56"N	44°57'01"E	Neolithic	N	N	N	7,500 BC	5,000 BC
Jaroměř	Eastern Europe	Poland	50°21'57"N	15°56'19"E	Neolithic	Stroked Pottery	N	N	5,100 BC	4,400 BC

Jerf el-Ahmar	Western Asia	Syria	36°23'01"N	38°10'50"E	Neolithic	PPNA	N	N	9,600 BC	8,500 BC
Jericho	Western Asia	Palestine	31°52'17"N	35°26'39"E	Neolithic	PPNB	N	N	8,500 BC	6,000 BC
Jordløse Mose	Northern Europe	Denmark	55°21'09"N	11°15'30"E	Neolithic	Funnel Beaker	N	N	3,900 BC	2,350 BC
Kääpa	Eastern Europe	Estonia	57°52'07"N	27°07'10"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC
Kalavasos-Tenta	Western Asia	Cyprus	34°45'09"N	33°18'12"E	Neolithic	PPNB	N	N	7,751 BC	7,250 BC
Kalmaküla	Eastern Europe	Estonia	58°53'40"N	26°58'24"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC
Kanaljordan	Northern Europe	Sweden	58°32'34"N	15°01'36"E	Mesolithic	N	N	N	6,361 BC	5,516 BC
Kaszás Domb	Eastern Europe	Hungary	46°26'25"N	20°13'43"E	Neolithic	Lengyel	N	N	5,000 BC	3,400 BC
Katra I	Northern Europe	Lithuania	53°59'21"N	24°34'15"E	Mesolithic	Kongemose	N	N	6,150 BC	5,700 BC
Kauniinmetsänniitty 1	Northern Europe	Finland	64°38'42"N	24°39'22"E	Neolithic	Comb Ware	N	N	3,670 BC	2,370 BC
Kfar HaHoresh	Western Asia	Israel	32°42'15"N	35°16'37"E	Neolithic	PPNB	N	N	8,000 BC	6,800 BC
Kharaysin	Western Asia	Jordan	32°12'14"N	36°00'32"E	Neolithic	PPNA; PPNB	9,894 BP	9,707 BP	N	N

Khirokitia	Western Asia	Cyprus	34°47'48"N	33°20'37"E	Neolithic	PPNB	N	N	5,800 BC	5,400 BC
Kierikin Sorakuoppa	Northern Europe	Finland	65°21'37"N	25°57'40"E	Neolithic	Comb Ware	N	N	3,650 BC	3,389 BC
Kierkkisaari	Northern Europe	Finland	65°21'28"N	25°56'54"E	Neolithic	Kierikki Ware	N	N	3,519 BC	3,358 BC
Kinbeachie	Northern Europe	United Kingdom	57°38'24"N	04°16'40" W	Neolithic	N	N	N	3,500 BC	2,920 BC
Kobyłki	Eastern Europe	Poland	51°27'16"N	19°24'30"E	Neolithic	Funnel Beaker	N	N	4,300 BC	2,800 BC
Kolín	Eastern Europe	Poland	50°02'31"N	15°10'35"E	Neolithic	Linear Pottery; Stroked Pottery	N	N	5,450 BC	4,350 BC
Kõnnu	Eastern Europe	Estonia	58°26'06"N	22°47'30"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC
Kõpu	Eastern Europe	Estonia	58°54'20"N	22°12'55"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC
Körtik Tepe	Western Asia	Turkey	37°48'50"N	40°59'22"E	Neolithic	PPNA	N	N	10,400 BC	9,250 BC
Kouvéléikès A and B	Southern Europe	Greece	36°59'59"N	22°41'58"E	Neolithic	N	N	N	N	N
Kowal 14	Eastern Europe	Poland	52°31'51"N	19°08'59"E	Neolithic	Globular Amphora	4,140 BP	3,940 BP	N	N
Kownacica	Eastern Europe	Poland	51°46'18"N	21°41'22"E	Neolithic	Funnel Beaker	N	N	3,650 BC	3,300 BC

Kralice na Hané	Eastern Europe	Czechia	49°28'02"N	17°10'50"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Kretuonas 1C	Northern Europe	Lithuania	55°15'12"N	26°04'56"E	Mesolithic	Kongemose	N	N	6,150 BC	5,700 BC
Krhov	Eastern Europe	Czechia	49°01'08"N	17°49'43"E	Neolithic	N	N	N	N	N
Kroodi	Eastern Europe	Estonia	59°27'31"N	25°00'59"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC
Künzing-Unternberg	Western Europe	Germany	48°42'00" N	13°06'00"E	Neolithic	Eneolithic	N	N	N	N
Kuuselankangas	Northern Europe	Finland	65°20'08"N	25°29'37"E	Neolithic	Kierikki Ware; Comb Ware	N	N	3,770 BC	3,100 BC
La Capoulière	Western Europe	France	43°35'59"N	04°01'30"E	Neolithic	N	N	N	3,000 BC	2,000 BC
La Draga	Southern Europe	Spain	42°07'42"N	02°45'27"E	Neolithic	Cardium	N	N	5,300 BC	5,150 BC
La Hougue Bie	Western Europe	Jersey	49°12'01"N	02°03'50" W	Neolithic	Chasséen	N	N	4,365 BC	3,360 BC
La Karelslé	Western Europe	Luxemburg	49°47'46"N	06°17'04"E	Neolithic	Rössen	5,990 BP	5,690 BP	N	N
La Molina	Southern Europe	Spain	37°16'12"N	04°49'35" W	Neolithic	N	N	N	3,000 BC	2,500 BC
La Revilla del Campo	Southern Europe	Spain	41°10'14"N	02°30'58" W	Neolithic	N	N	N	5,400 BC	4,500 BC

La Rouvière	Western Europe	France	43°53'20"N	03°34'20"E	Neolithic	N	N	N	3,000 BC	3,000 BC
Lackford Heath	Northern Europe	United Kingdom	52°18'48"N	00°36'35"E	Mesolithic	Deepcar	10,550 BP	9,950 BP	N	N
Laigh Newton	Northern Europe	United Kingdom	55°36'21"N	04°13'54"W	Neolithic	N	N	N	4,350 BC	2,030 BC
Leira das Mamas	Southern Europe	Portugal	41°30'12"N	08°25'54" W	Neolithic	N	N	N	4,000 BC	3,000 BC
Lenk-Schnidejoch	Western Europe	Switzerland	46°22′09″ N	07°23′20″E	Neolithic	N	N	N	2,884 BC	2,578 BC
Lepenski Vir	Eastern Europe	Serbia	44°33'40"N	22°01'27"E	Neolithic	N	N	N	6,300 BC	6,000 BC
Lerna	Southern Europe	Greece	37°33'04"N	22°43'07"E	Neolithic	N	N	N	N	N
Lešany	Eastern Europe	Czechia	50°04'32"N	14°26'42"E	Neolithic	N	N	N	N	N
Lilla Loshults Mosse	Northern Europe	Sweden	56°30'08"N	14°06'50"E	Mesolithic	Maglemose	N	N	8,280 BC	7,790 BC
Limenaria	Southern Europe	Greece	40°37'58"N	24°34'29"E	Neolithic	N	N	N	5,500 BC	5,000 BC
Liptovské Matiašovce-Bochníčky	Eastern Europe	Slovakia	49°08'30" N	19°32'48"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Lommi	Eastern Europe	Russia	59°25'21"N	28°17'35"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC

Lonche	Southern Europe	Slovenia	45°29'59"N	13°53'60"E	Neolithic	N	N	N	6,655 BC	6,400 BC
Ludwinowo 7	Eastern Europe	Poland	52°33'58"N	19°00'19"E	Neolithic	Linear Pottery	N	N	5,200 BC	5,000 BC
Magareći Mlin	Southern Europe	Serbia	45°37'25"N	19°01'16"E	Neolithic	N	N	N	6,200 BC	5,600 BC
Mägura-Buduiasca	Eastern Europe	Romania	44°01'43"N	25°23'33"E	Neolithic	Ovcharo-Samovodene	N	N	5,500 BC	5,400 BC
Makri	Southern Europe	Greece	40°50'53"N	25°44'35"E	Neolithic	N	N	N	6,200 BC	5,200 BC
Makriyalos 1	Southern Europe	Greece	40°25'01"N	22°34'42"E	Neolithic	N	N	N	5,670 BC	4,900 BC
Mala Triglavca	Southern Europe	Slovenia	45°40'21"N	13°57'32"E	Neolithic	Vlaŝka	N	N	5,480 BC	4,261 BC
Målevgård Mose	Northern Europe	Denmark	55°39'35"N	12°15'03"E	Neolithic	Funnel Beaker	N	N	3,900 BC	2,350 BC
Mali Alas	Southern Europe	Serbia	45°06'14"N	20°24'03"E	Neolithic	Vinča	N	N	5,700 BC	4,500 BC
Mandra Antine	Southern Europe	Italy	40°30'45"N	08°37'57"E	Neolithic	N	N	N	N	N
Mas d'Is	Southern Europe	Spain	38°41'02"N	00°24'08" W	Neolithic	N	N	N	5,600 BC	5,300 BC
Matesjski Brod	Southern Europe	Serbia	45°39'01"N	20°10'38"E	Neolithic	N	N	N	N	N

Meilen-Rorenhaab	Western Europe	Switzerland	47°15′50″N	08°39′37″E	Neolithic	N	N	N	4,000 BC	2,500 BC
Melkoya	Northern Europe	Norway	70°41'16"N	23°35'44"E	Neolithic	N	4,935 BP	3,000 BP	N	N
Mentesh Tepe	Western Asia	Azerbaijan	41°01'08"N	45°35'23"E	Neolithic	Shulaveri-Shomu	N	N	5,882 BC	5,536 BC
Moghr el-Ahwal	Western Asia	Lebanon	34°17'28"N	35°52'49"E	Late Epipalaeolithic	Natufian	14,463 BP	13,859 BP	N	N
Moltzow	Western Europe	Germany	53°37'49"N	12°35'54"E	Neolithic	Funnel Beaker	N	N	3,500 BC	2,800 BC
Mondeval de Sora	Southern Europe	Italy	46°27'60"N	12°05'38"E	Mesolithic	Castelnovian	N	N	6,430 BC	6,210 BC
Mondsee	Western Europe	Austria	47°47'57"N	13°25'47"E	Neolithic	Mondsee	N	N	5,800 BC	4,700 BC
Moosseedorf	Western Europe	Switzerland	47°01'09"N	07°29'11"E	Neolithic	N	N	N	4,554 BC	4,462 BC
Mosegarden	Northern Europe	Denmark	55°52'57"N	09°59'36"E	Neolithic	N	N	N	3,130 BC	2,900 BC
Motza	Western Asia	Israel	31°47'37"N	35°10'06"E	Neolithic	PPNB; Jericho IX; Pottery Neolithic	N	N	8,600 BC	4,500 BC
Moverna Vas	Southern Europe	Slovenia	45°37'51"N	15°13'43"E	Neolithic	N	N	N	4,945 BC	4,265 BC
Moẓa	Western Asia	Israel	31°47'31"N	35°09'48"E	Neolithic	PPNB	N	N	7,000 BC	6,700 BC

MR11	Western Asia	United Arab Emirates	24°16'36"N	53°15'27"E	Neolithic	N	N	N	5,725 BC	5,526 BC
Mrowino 3	Eastern Europe	Poland	52°30'23"N	16°42'24"E	Neolithic	Funnel Beaker	N	N	3,300 BC	2,970 BC
Munhatta	Western Asia	Israel	32°36'25"N	35°33'01"E	Neolithic	PPNA	N	N	N	N
Mureybet	Western Asia	Syria	36°02'36"N	38°07'43"E	Neolithic	PPNA	9,750 BP	8,760 BP	N	N
Mursalevo-Deveboaz	Eastern Europe	Bulgaria	42°06'45"N	23°02'12"E	Neolithic	N	N	N	5,700 BC	4,900 BC
Nahal Ein Gev II	Western Asia	Israel	32°46'27"N	35°40'35"E	Late Epipalaeolithic	Natufian	12,500 BP	12,000 BP	N	N
Nahal Hemar	Western Asia	Israel	31°08'08"N	35°19'40"E	Neolithic	PPNB	N	N	8,920 BC	7,100 BC
Nahal Yarmuth 38	Western Asia	Israel	31°42'53"N	34°58'10"E	Neolithic	PPNB	N	N	8,800 BC	6,500 BC
Nakonowo Stare 2	Eastern Europe	Poland	52°33'01"N	19°03'21"E	Neolithic	Globular Amphora	4,265 BP	3,980 BP	N	N
Narva Joaorg	Eastern Europe	Estonia	59°22'17"N	28°12'16"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC
Nebelivka	Eastern Europe	Ukraine	48°38'21"N	30°33'19"E	Neolithic	Cucuteni–Trypillia	N	N	3,970 BC	3,770 BC
Nemea 702	Southern Europe	Greece	37°47'42"N	22°44'28"E	Neolithic	N	N	N	N	N

Nemrik 9	Western Asia	Iraq	36°43'43"N	42°51'04"E	Neolithic	PPNA; PPNB	10,150 BP	8,000 BP	N	N
Ness of Brodgar	Northern Europe	United Kingdom	58°59'50"N	03°12'53"W	Neolithic	Grooved Ware	N	N	3,300 BC	2,200 BC
Neuenfeld 17	Western Europe	Germany	53°25'31"N	14°01'03"E	Neolithic	Funnel Beaker	N	N	3,860 BC	3,860 BC
Newgrange	Northern Europe	Ireland	53°41′41″N	06°28′32″ W	Neolithic	N	N	N	3,200 BC	2,000 BC
Niederhummel	Western Europe	Germany	48°24'00" N	11°54'00"E	Neolithic	N	N	N	5,360 BC	5,220 BC
Niuet	Southern Europe	Spain	38°47'02"N	00°22'35" W	Neolithic	N	N	N	4,500 BC	2,800 BC
Nußdorf	Western Europe	Germany	47°45'12"N	09°11'41"E	Neolithic	N	N	N	N	N
Obšrūtai	Northern Europe	Lithuania	54°41'14"N	23°08'47"E	Mesolithic	N	8,277 BP	8,259 BP	N	N
Orca da Lapa do Lobo	Southern Europe	Portugal	40°26'38"N	07°56'17"W	Neolithic	N	N	N	5,000 BC	3,000 BC
Ordea-Salca	Eastern Europe	Romania	47°02'21"N	21°56'51"E	Neolithic	Alföld Linear Pottery	N	N	5,200 BC	5,000 BC
Orehøj Mose	Northern Europe	Denmark	55°44'22"N	12°34'12"E	Neolithic	Funnel Beaker	N	N	3,900 BC	2,350 BC
Ostorf-Tannenwerder I	Western Europe	Germany	53°36'30"N	11°23'46"E	Neolithic	Funnel Beaker	N	N	3,400 BC	2,900 BC

Otice-Rybníčky	Eastern Europe	Czechia	49°54'17"N	17°52'46"E	Neolithic	Lengyel	N	N	3,941 BC	3,707 BC
Oulu Vepsänkangas	Northern Europe	Finland	64°59'26"N	26°13'19"E	Mesolithic	N	6,260 BP	5,930 BP	N	N
Øvre Storvatnet	Northern Europe	Norway	59°20'01"N	06°56'37"E	Mesolithic	Ertebølle	6,030 BP	5,920 BP	N	N
Pakretuonė 4	Northern Europe	Lithuania	55°15'55"N	26°04'33"E	Mesolithic	Kongemose	N	N	6,150 BC	5,700 BC
Paliambela	Southern Europe	Greece	40°30'41"N	22°30'11"E	Neolithic	N	N	N	6,600 BC	5,000 BC
Palù di Livenza	Southern Europe	Italy	46°01'17"N	12°28'55"E	Neolithic	N	N	N	3,950 BC	3,650 BC
Parkhaus Opéra	Western Europe	Switzerland	47°21'54"N	08°32'50"E	Neolithic	N	N	N	3,176 BC	3,153 BC
Pas de la Charmate	Western Europe	France	45°13'20"N	05°38'46"E	Mesolithic	Sauvterrian	N	N	7,974 BC	7,056 BC
Pavlovac-Gumnište	Southern Europe	Serbia	42°29'24"N	21°51'06"E	Neolithic	Vinča	N	N	5,300 BC	4,500 BC
Pestenacker	Western Europe	Germany	48°09'20" N	10°56'36"E	Neolithic	Altheim	N	N	3,496 BC	3,410 BC
Pfyn-Breitenloo	Western Europe	Switzerland	47°36'09"N	08°55'44"E	Neolithic	Pfyn	N	N	3,706 BC	3,704 BC
Piana di Curinga	Southern Europe	Italy	38°49'48"N	16°15'26"E	Neolithic	Impressed Ware	6,990 BP	6,870 BP	N	N

Pijnacker	Western Europe	Netherlands	52°01'09"N	04°25'57"E	Mesolithic	N	N	N	N	N
Plan da Mattun	Western Europe	Switzerland	46°51'00"N	10°13'44"E	Mesolithic	N	N	N	8,630 BC	8,330 BC
Poças de São Bento	Southern Europe	Portugal	38°14'44"N	08°26'34" W	Mesolithic	N	N	N	6,211 BC	3,984 BC
Pod Křídlem	Eastern Europe	Czechia	50°39'37"N	14°30'17"E	Mesolithic	N	9,124 BP	9,124 BP	N	N
Pod Zubem	Eastern Europe	Czechia	50°39'49"N	14°30'41"E	Mesolithic	N	9,025 BP	7,461 BP	N	N
Podlesie	Eastern Europe	Poland	50°31'06"N	21°04'34"E	Neolithic	Linear Pottery	N	N	5,211 BC	4,962 BC
Podrî l'Cortri	Western Europe	Belgium	50°41'20"N	05°24'10"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Pokrovnik	Southern Europe	Croatia	43°48'25"N	16°04'01"E	Neolithic	N	N	N	5,300 BC	5,100 BC
Polgar-10	Eastern Europe	Hungary	47°52'39"N	21°09'48"E	Neolithic	N	N	N	5,480 BC	4,900 BC
Polgár-Bosnyákdomb	Eastern Europe	Hungary	47°50'23"N	21°05'34"E	Neolithic	Tisza	N	N	4,583 BC	4,464 BC
Polgár-Csőszhalom	Eastern Europe	Hungary	47°52'00"N	21°06'60"E	Neolithic	Tisza	N	N	4,985 BC	4,610 BC
Polwica-Skrzypnik	Eastern Europe	Poland	50°54'01"N	17°10'33"E	Neolithic	Funnel Beaker	N	N	3,525 BC	3,366 BC

Profitis Ilias Rizoupolis	Southern Europe	Greece	38°01'37"N	23°44'25"E	Neolithic	N	N	N	5,400 BC	4,600 BC
Promahonas	Southern Europe	Greece	41°21'49"N	23°21'35"E	Neolithic	N	N	N	5,280 BC	4,360 BC
Ptaszkowice	Eastern Europe	Poland	51°32'16"N	18°56'12"E	Neolithic	Funnel Beaker	N	N	4,300 BC	2,800 BC
Pulli	Northern Europe	Estonia	58°25'28"N	24°39'57"E	Mesolithic	N	N	N	8,700 BC	8,550 BC
Qumran Cave 24	Western Asia	Palestine	31°44'31"N	35°27'37"E	Neolithic	PPNB	10,615 BP	8,230 BP	N	N
R39	Northern Europe	Norway	61°14'06"N	11°24'48"E	Neolithic	Slate	N	N	N	N
RAÄ 1372	Northern Europe	Sweden	66°16'59"N	15°47'18"E	Neolithic	N	N	N	3,340 BC	3,100 BC
Rääkkylä Pörrinmökki	Northern Europe	Finland	62°13'52"N	29°47'24"E	Neolithic	Comb Ware	N	N	3,890 BC	3,660 BC
Rakushechny Yar	Eastern Europe	Russia	47°33'36"N	40°40'40"E	Neolithic	N	N	N	5,600 BC	5,400 BC
Rekem	Western Europe	Belgium	50°55'22"N	05°41'38"E	Mesolithic	Federmesser	11,500 BP	11,200 BP	N	N
Rheinhausen	Western Europe	Germany	48°14'52"N	07°43'19"E	Neolithic	Linear Pottery	N	N	5,300 BC	4,900 BC
Riigiküla IV	Eastern Europe	Estonia	59°25'20"N	28°07'20"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC

Ringsjöholm	Northern Europe	Sweden	55°53'59"N	13°25'51"E	Mesolithic	N	N	N	5,960 BC	5,200 BC
Riparo Gaban	Southern Europe	Italy	46°05'35"N	11°07'28"E	Mesolithic; Neolithic	Castelnovian; Gaban	N	N	6,226 BC	4,459 BC
Ripatetta	Southern Europe	Italy	41°22'15"N	15°12'07"E	Neolithic	N	N	N	5,800 BC	5,000 BC
Risby Warren	Northern Europe	United Kingdom	53°36'42"N	00°35'58" W	Neolithic	N	N	N	N	N
Rockanje	Western Europe	Netherlands	51°52'11"N	04°02'55"E	Mesolithic	N	N	N	N	N
Rönneholms Mosse	Northern Europe	Sweden	55°55'32"N	13°25'17"E	Mesolithic	Maglemose	N	N	7,032 BC	6,644 BC
Rosheim	Western Europe	France	48°29'47"N	07°28'05"E	Neolithic	Linear Pottery; Grossgartach; Rössen	N	N	5,500 BC	4,300 BC
Rovantsi	Eastern Europe	Ukraine	50°43'44"N	25°20'29"E	Neolithic	Linear Pottery	6,316 BP	6,223 BP	N	N
Rożniaty 2	Eastern Europe	Poland	52°41'58"N	18°18'01"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Rudna Wielka 5	Eastern Europe	Poland	50°05'15"N	21°57'08"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Ruhnu II	Eastern Europe	Estonia	57°48'16"N	23°14'26"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC
Runnymede Bridge	Northern Europe	United Kingdom	51°24'00"N	00°30'00" W	Neolithic	N	N	N	2,930 BC	2,510 BC

Ryńsk 42	Eastern Europe	Poland	53°13'50"N	18°49'17"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Saarijärvi Summassaari Uimaranta	Northern Europe	Finland	62°39'53"N	25°19'53"E	Neolithic	N	6,125 BP	5,980 BP	N	N
Saflulim	Western Asia	Israel	30°29'36"N	34°33'45"E	Late Epipalaeolithic	Natufian	11,250 BP	10,800 BP	N	N
Salibiya IX	Western Asia	Palestine	32°00'01"N	35°25'29"E	Neolithic	Khiamian	N	N	9,700 BC	8,600 BC
San Martino	Southern Europe	Italy	38°12'34"N	15°23'14"E	Neolithic	Stentinello II; Diana	N	N	4,800 BC	3,900 BC
San Rocco	Southern Europe	Italy	45°35'34"N	13°50'52"E	Neolithic	N	N	N	4,000 BC	2,000 BC
San Sebastiano di Perti	Southern Europe	Italy	44°11'10"N	08°18'34"E	Neolithic	Impressed Ware	N	N	5,730 BC	5,610 BC
Sant'Andrea Priu	Southern Europe	Italy	40°25'18"N	08°50'50"E	Neolithic	N	N	N	4,000 BC	2,700 BC
Šarišské Michaľany	Eastern Europe	Slovakia	49°04'11"N	21°08'10"E	Neolithic	Tiszadob	4,410 BP	4,350 BP	N	N
Sarnevo	Eastern Europe	Bulgaria	42°21'18"N	25°51'12"E	Neolithic	N	N	N	5,400 BC	5,200 BC
Sarnowo	Eastern Europe	Poland	52°29'12"N	18°45'10"E	Neolithic	Funnel Beaker	N	N	4,459 BC	4,343 BC
Schipluiden	Western Europe	Netherlands	52°00'56"N	04°19'09"E	Neolithic	Hasendonk 3	N	N	3,750 BC	3,400 BC

Segebro	Northern Europe	Sweden	55°36'17"N	13°00'08"E	Mesolithic	Kongemose	N	N	6,000 BC	5,200 BC
Sha'ar HaGolan	Western Asia	Israel	32°40'49"N	35°36'31"E	Neolithic	Yarmoukian	7,545 BP	6,880 BP	N	N
Shanidar	Western Asia	Iraq	36°48'03"N	44°14'31"E	Late Epipalaeolithic	N	10,600 BP	10,600 BP	N	N
Shaqarat Mazyad	Western Asia	Jordan	30°26'45"N	35°26'23"E	Neolithic	PPNB	N	N	5,560 BC	4,495 BC
Sheikh Ali	Western Asia	Israel	32°43'47"N	35°30'54"E	Neolithic	PPNB	N	N	N	N
Shir	Western Asia	Syria	35°12'04"N	36°37'45"E	Neolithic	N	N	N	7,050 BC	6,100 BC
Shkârat Msaied	Western Asia	Jordan	30°26'40"N	35°26'20"E	Neolithic	PPNB	9,680 BP	8,800 BP	N	N
Sierentz	Western Europe	France	47°39'20"N	07°27'22"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Siniarzewo 1	Eastern Europe	Poland	52°43'57"N	18°41'09"E	Neolithic	Linear Pottery	5,570 BP	4,305 BP	N	N
Slatinky	Eastern Europe	Czechia	49°32'55"N	17°05'38"E	Neolithic	Linear Pottery	N	N	3,807 BC	3,806 BC
Şoimuš - La Avicola	Eastern Europe	Romania	45°54'29"N	22°53'42"E	Neolithic	N	N	N	5,250 BC	4,750 BC
Sorisdale	Northern Europe	United Kingdom	56°40'52"N	06°27'27" W	Neolithic	N	N	N	5,500 BC	4,500 BC

Spiginas Grave 1	Northern Europe	Lithuania	55°46'01"N	22°25'57"E	Mesolithic	Kongemose	N	N	6,000 BC	5,200 BC
St. Aubin-Tivoli/Port-Conty	Western Europe	Switzerland	46°53′25″ N	06°46′15″E	Neolithic	Cortaillod	N	N	6,150 BC	5,700 BC
Stanovoye 4	Eastern Europe	Russia	57°12'56"N	40°20'16"E	Mesolithic	Butovo	10,370 BP	8,480 BP	N	N
Star Carr	Northern Europe	United Kingdom	54°12′51″N	00°25′24″ W	Mesolithic	Star Carr	N	N	9,335 BC	8,440 BC
Starčevo	Southern Europe	Serbia	44°49'03"N	20°34'19"E	Neolithic	Vinča	N	N	5,686 BC	5,460 BC
Stavroupoli	Southern Europe	Greece	40°39'59"N	22°55'59"E	Neolithic	N	N	N	5,839 BC	5,531 BC
Storbreen	Northern Europe	Norway	62°19'33"N	09°15'40"E	Neolithic	N	N	N	3,361 BC	3,102 BC
Store Brokhøj	Northern Europe	Denmark	56°30'23"N	10°26'41"E	Neolithic	Funnel Beaker	N	N	3,400 BC	3,400 BC
Stránska Skála	Eastern Europe	Czechia	49°11'18"N	16°40'54"E	Neolithic	Lengyel; Moravian Painted Ware; Funnel Beaker	5,568 BP	4,835 BP	N	N
Su Littu	Southern Europe	Italy	40°09'37"N	08°58'26"E	Neolithic	N	N	N	N	N
Suplacu de Barcau	Eastern Europe	Romania	47°15'32"N	22°32'25"E	Neolithic	N	N	N	N	N

Sutz-Lattrigen Aussen	Western Europe	Switzerland	47°05'55"N	07°12'50"E	Neolithic	Horgen	N	N	3,201 BC	3,047 BC
Šventoji 1	Northern Europe	Lithuania	56°01'32"N	21°04'51"E	Neolithic	Corded Ware	N	N	2,700 BC	2,400 BC
Šventoji 3	Northern Europe	Lithuania	56°01'33"N	21°04'54"E	Mesolithic	N	N	N	3,420 BC	2,700 BC
Šventoji 4	Northern Europe	Lithuania	56°01'30"N	21°04'49"E	Mesolithic	N	N	N	3,420 BC	2,700 BC
Šventoji 6	Northern Europe	Lithuania	56°01'28"N	21°04'34"E	Mesolithic	N	N	N	3,420 BC	2,700 BC
Sweet Track F	Northern Europe	United Kingdom	51°09'51"N	02°49'35" W	Neolithic	N	N	N	3,807 BC	3,806 BC
Swifterbant S3	Western Europe	Netherlands	52°34'45"N	05°34'57"E	Neolithic	N	N	N	4,300 BC	4,000 BC
Syltholm	Northern Europe	Denmark	54°39'45"N	11°21'23"E	Neolithic	Ertebølle/ Funnel Beaker	5,858 BP	5,661 BP	N	N
Szakmár–Kisülés	Eastern Europe	Hungary	46°32'24"N	19°03'50"E	Neolithic	Starčevo–Körös–Criş	N	N	5,800 BC	5,700 BC
Szeghalom-Kovácshalom	Eastern Europe	Hungary	46°59'18"N	21°09'30"E	Neolithic	Tisza	N	N	4,900 BC	4,500 BC
Tabaqat al-Buma	Western Asia	Jordan	32°34'52"N	35°41'52"E	Neolithic	N	N	N	5,600 BC	5,100 BC
Tappeh Sang-e Chakhmaq	Western Asia	Iran	36°29'59"N	55°00'02"E	Neolithic	N	N	N	7,200 BC	5,200 BC

Täuffelen	Western Europe	Switzerland	47°04'01"N	07°12'00"E	Neolithic	N	N	N	N	N
Tel Dan	Western Asia	Israel	33°14'55"N	35°39'07"E	Neolithic	Pottery Neolithic	N	N	N	N
Tel Teo	Western Asia	Israel	33°08'40" N	35°34'06"E	Neolithic	PPNB	N	N	8,800 BC	6,500 BC
Tell Abu as-Sawwan	Western Asia	Jordan	32°14'56"N	35°55'54"E	Neolithic	PPNB	N	N	7,470 BC	6,420 BC
Tell al-Raqai	Western Asia	Syria	36°26'54"N	40°51'28"E	Neolithic	N	N	N	N	N
Tell Assouad	Western Asia	Syria	35°55'17"N	39°11'12"E	Neolithic	Halafian	N	N	6,600 BC	6,000 BC
Tell Aswad	Western Asia	Syria	33°23'59"N	36°33'01"E	Neolithic	PPNB; Pottery Neolithic	N	N	9,500 BC	8,500 BC
Tell Bouqras	Western Asia	Syria	35°05'07"N	40°23'51"E	Neolithic	PPNA	N	N	6,400 BC	5,900 BC
Tell Damishliyya	Western Asia	Syria	36°29'38"N	39°02'47"E	Neolithic	PPNB	N	N	6,100 BC	5,700 BC
Tell el'Far'ah	Western Asia	Israel	31°16'57"N	34°28'58"E	Neolithic	PPNB	N	N	N	N
Tell el'Oueili	Western Asia	Iraq	31°14'35"N	45°53'06"E	Neolithic	‘Ubaid	N	N	6,500 BC	4,300 BC
Tell Feyda	Western Asia	Syria	36°36'46"N	40°23'32"E	Neolithic	PPNB	N	N	6,500 BC	6,000 BC

Tell Gudeda	Western Asia	Syria	36°25'24"N	40°51'26"E	Neolithic	N	N	N	N	N
Tell Hadidi	Western Asia	Syria	36°15'53"N	38°09'02"E	Neolithic	N	N	N	2,000 BC	1,500 BC
Tell Halula	Western Asia	Syria	36°25'09"N	38°10'49"E	Neolithic	PPNB; Pre-Halafian; Halafian	N	N	7,590 BC	5,300 BC
Tell Kashkashok I	Western Asia	Syria	36°34'52"N	40°27'17"E	Neolithic	Halafian	N	N	5,831 BC	5,580 BC
Tell Kosak Shamali	Western Asia	Syria	36°33'56"N	38°16'45"E	Neolithic	‘Ubaid	N	N	5,300 BC	4,260 BC
Tell Labweh	Western Asia	Lebanon	34°11'44"N	36°21'22"E	Neolithic	PPNA	N	N	5,950 BC	5,950 BC
Tell Maghzaliyah	Western Asia	Iraq	36°23'46"N	42°16'06"E	Neolithic	Pre-Hassuna	N	N	8,000 BC	7,000 BC
Tell Mashnaqa	Western Asia	Syria	36°17'18"N	40°47'41"E	Neolithic	‘Ubaid	N	N	5,250 BC	5,000 BC
Tell Mounbatah	Western Asia	Syria	36°20'22"N	39°02'42"E	Neolithic	N	N	N	*8,250 BC*	6,500 BC
Tell Qarassa	Western Asia	Syria	32°50'05"N	36°24'40"E	Neolithic	PPNB	N	N	8,730 BC	8,349 BC
Tell Rakan I	Western Asia	Jordan	32°29'57"N	35°37'54"E	Neolithic	Yarmoukian	N	N	7,500 BC	6,790 BC
Tell Ramad	Western Asia	Syria	33°21'37"N	35°56'56"E	Neolithic	PPNB	N	N	6,330 BC	5,985 BC

Tell Sabi Abyad I	Western Asia	Syria	36°30'14"N	39°05'34"E	Neolithic	Burnt Village; Halafian	N	N	6,500 BC	6,000 BC
Tell Sabi Abyad II	Western Asia	Syria	36°30'30"N	39°05'24"E	Neolithic	PPNB	N	N	6,500 BC	6,000 BC
Tell Samovodene	Eastern Europe	Bulgaria	43°08'46"N	25°36'48"E	Neolithic	N	N	N	5,750 BC	5,400 BC
Tell Seker al-Aheimar	Western Asia	Syria	36°36'30"N	40°23'20"E	Neolithic	PPNB	8,035 BP	7,895 BP	N	N
Tell Yosef	Western Asia	Israel	32°31'41"N	35°24'04"E	Neolithic	Pottery Neolithic	N	N	6,570 BC	6,200 BC
Tell-e Atashi	Southern Asia	Iran	29°05'44"N	58°50'06"E	Neolithic	PPN	N	N	5,500 BC	5,000 BC
Telul eth-Thalathat	Western Asia	Iraq	36°34'08"N	42°32'08"E	Neolithic	Proto-Hassuna	7,640 BP	6,390 BP	N	N
Tepe Khaleseh	Southern Asia	Iran	36°11'22"N	49°10'28"E	Neolithic	N	N	N	6,000 BC	5,500 BC
Tepe Tula'i	Southern Asia	Iran	32°21'54"N	48°12'00"E	Neolithic	Mohammed Jaffar; Sefid	N	N	6,200 BC	5,900 BC
Têšetice-Kyjovice	Eastern Europe	Czechia	48°53'41"N	16°08'19"E	Neolithic	Linear Pottery; Stroked Pottery; Painted Pottery; Lengyel	6,240 BP	5,905 BP	N	N
Thatcham III	Northern Europe	United Kingdom	51°24'04"N	01°17'20"W	Mesolithic	Deepcar	10,535 BP	9,110 BP	N	N

Théopetra	Southern Europe	Greece	39°30'00" N	21°48'00"E	Neolithic	N	9,030 BP	6,180 BP	N	N
Tiefbrunn	Western Europe	Germany	48°55'58"N	12°15'35"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Tiszaszőlős-Domaháza	Eastern Europe	Hungary	47°35'02"N	20°42'57"E	Neolithic	Starčevo–Körös–Criș	N	N	5,710 BC	5,630 BC
Tominy 6	Eastern Europe	Poland	50°51'10"N	21°40'56"E	Neolithic	Linear Pottery	N	N	5,500 BC	4,500 BC
Toptepe	Western Asia	Turkey	40°57'60"N	27°52'42"E	Neolithic	N	N	N	5,500 BC	5,000 BC
Tor Hamar	Western Asia	Jordan	29°56'17"N	35°19'12"E	Late Epipalaeolithic	Madamaghan	13,006 BP	12,360 BP	N	N
Toumba Kremastis Koiladas	Southern Europe	Greece	40°21'50"N	21°56'12"E	Neolithic	N	N	N	5,340 BC	4,930 BC
Tsirmiris	Southern Europe	Greece	34°50'41"N	24°05'59"E	Neolithic	Final Neolithic	N	N	3,300 BC	2,500 BC
Uğurlu	Western Asia	Turkey	40°07'27"N	25°42'23"E	Neolithic	N	N	N	6,800 BC	6,500 BC
Uivar	Eastern Europe	Romania	45°40'41"N	20°52'31"E	Neolithic	Vinča	N	N	5,230 BC	4,935 BC
Ullafelsen	Western Europe	Austria	47°10'33"N	11°12'54"E	Mesolithic	N	N	N	9,000 BC	8,500 BC
Ulucak Höyük	Western Asia	Turkey	38°28'00" N	27°21'09"E	Neolithic	N	N	N	6,390 BC	5,700 BC

Vaikantonys	Northern Europe	Lithuania	54°23'10"N	24°25'06"E	Mesolithic	N	N	N	7,520 BC	7,300 BC
Vassilara Rachi	Southern Europe	Greece	40°14'51"N	22°04'51"E	Neolithic	N	N	N	5,800 BC	4,900 BC
Vchynice	Eastern Europe	Czechia	50°30'38"N	14°01'12"E	Neolithic	Stroked Pottery: Linear Pottery	N	N	5,100 BC	4,500 BC
Vedrovice	Eastern Europe	Czechia	49°01'13"N	16°22'32"E	Neolithic	Linear Pottery	N	N	5,490 BC	4,850 BC
Vésztő-Bikeri	Eastern Europe	Hungary	46°55'20"N	21°12'12"E	Neolithic	Tiszapolgar	N	N	4,600 BC	4,200 BC
Vihasoo III	Eastern Europe	Estonia	59°33'32"N	25°47'37"E	Neolithic	Narva	N	N	5,200 BC	3,900 BC
Vinča-Belo Brdo	Southern Europe	Serbia	44°45'43"N	20°37'23"E	Neolithic	Vinča	N	N	5,600 BC	4,500 BC
Vinelz	Western Europe	Switzerland	47°02'21"N	07°06'34″E	Neolithic	N	N	N	4,000 BC	2,500 BC
Virgen de Siete Iglesias	Southern Europe	Spain	41°25'00"N	04°47'00" W	Neolithic	N	N	N	N	N
Vlasac	Southern Europe	Serbia	44°32'06"N	22°02'38"E	Mesolithic	N	N	N	6,823 BC	6,411 BC
Vrbjanska Čuka	Southern Europe	North Macedonia	41°19'22"N	21°23'56"E	Neolithic	N	N	N	N	N
Wadi al-Qattafi	Western Asia	Jordan	31°48'49"N	38°01'40"E	Neolithic	N	N	N	5,480 BC	5,320 BC

Wadi Murabba'at	Western Asia	Palestine	31°35'09"N	35°22'27"E	Neolithic	N	10,265 BP	10,175 BP	N	N
Wadi Shu'eib	Western Asia	Jordan	31°58'24"N	35°43'39"E	Neolithic	PPNB; PPNC	N	N	8,490 BC	6,060 BC
Wangen-Hinterhorn	Western Europe	Germany	47°39'39"N	08°56'20"E	Neolithic	N	N	N	4,000 BC	2,500 BC
Wetzikon-Robenhausen	Western Europe	Switzerland	47°20'09"N	08°47'08"E	Neolithic	N	N	N	N	N
WF16	Western Asia	Jordan	30°36'28"N	35°26'55"E	Neolithic	PPNA	11,600 BP	10,200 BP	N	N
Wisad Pools	Western Asia	Jordan	31°48'17"N	38°01'58"E	Neolithic	N	N	N	6,730 BC	6,455 BC
Wolica Nowa 1	Eastern Europe	Poland	52°46'58"N	18°27'01"E	Neolithic	Linear Pottery	N	N	5,200 BC	5,000 BC
Yabalkovo	Eastern Europe	Bulgaria	42°04'11"N	25°26'26"E	Neolithic	N	N	N	5,685 BC	5,427 BC
Yarim Tepe I	Western Asia	Iraq	36°19'15"N	42°22'07"E	Neolithic	Hassuna; Halafian	N	N	5,750 BC	4,990 BC
Yarim Tepe II	Western Asia	Iraq	36°19'15"N	42°21'56"E	Neolithic	Halafian	N	N	5,020 BC	4,080 BC
Yiftahel	Western Asia	Israel	32°45'19"N	35°13'40"E	Neolithic	PPNB	N	N	8,005 BC	7,570 BC
Zahrat adh-Dhra‘ 2	Western Asia	Jordan	31°17'00"N	35°35'01"E	Neolithic	PPNA	N	N	9,250 BC	8,330 BC

Zalaszentbalázs-Szölöhegyi	Eastern Europe	Hungary	46°35'17"N	16°55'06"E	Neolithic	Lengyel	N	N	4,500 BC	4,000 BC
Zambujeiro	Southern Europe	Portugal	38°32'21"N	08°00'51" W	Neolithic	N	N	N	4,000 BC	3,000 BC
Zamostje 2	Eastern Europe	Russia	56°40'35"N	38°00'36"E	Mesolithic	N	N	N	6,500 BC	4,000 BC
Zduńska Wola-Nowe Miasto	Eastern Europe	Poland	51°35'57"N	18°56'21"E	Neolithic	Funnel Beaker	N	N	4,300 BC	2,800 BC
Zgornje Radvanje	Southern Europe	Slovenia	46°32'13"N	15°35'59"E	Neolithic	Eneolithic	N	N	4,355 BC	4,186 BC
Zsadány-Püski-Hügel	Eastern Europe	Hungary	46°55'20"N	21°29'10"E	Neolithic	Theiß; Szakalhat; Esztar	N	N	5,260 BC	4,880 BC
Żuławka 13	Eastern Europe	Poland	53°05'54"N	17°15'53"E	Neolithic	Funnel Beaker	N	N	3,500 BC	3,370 BC

Table 9. Archaeological site data.

Record ID	References	Site Name	Adhesive Traces	Nature of Evidence
ARC-001	1 - Moore (1978)	Abu Gosh	Residues	The floors of some buildings were plastered.
ARC-002	1 - Ridout-Sharpe (2015); 2 - Cauvin (2003); 3 - Moore (1978); 4 - Moore, Hillman and Legge (1975)	Abu Hureyra	Residues	The walls and floors of buildings were plastered white with mud. Designs were painted onto some of these plaster floors in black or red. Internal features like platforms were made from plaster or lined with it.
ARC-003	1 - Ridout-Sharpe (2015); 2 - Moore, Hillman and Legge (1975)	Abu Hureyra	Residues	Bitumen was used to plug a hole in a mollusc shell. Storage bins were lined with plaster.
ARC-004	1 - Moore (1978); 2 - Moore, Hillman and Legge (1975)	Abu Hureyra	Lumps	Reed impressions on bitumen and plaster lumps indicated use in waterproofing containers or making them rodent resistant.
ARC-005	1 - Kingery, Vandiver and Prickett (1988)	Abu Hureyra	Lumps	A ball of pure gypsum plaster was recovered.
ARC-006	1 - Kingery, Vandiver and Prickett (1988); 2 - Moore (1978)	Abu Hureyra	Lumps	A white ware vessel made from gypsum plaster mixed with aggregate content was recovered. Heavier vessels made from pure gypsum plaster were likely used for storage.
ARC-007	1 - Moore (1978)	Adh Dhaman	Residues	The floors of some buildings were plastered.
ARC-008	1 - Boethius *et al.* (2020)	Ageröd I	Residues	A slotted bone point with brownish resin fixing microliths into its upper part was recovered. A flint microlith found hafted with similar resin coated with bone dust was interpreted as the remains of another slotted bone point.

ARC-009	1 - Van de Velde (2015b); 2 - Connan and Carter (2007); 3 - McClure and al-Shaikh (1993)	Ain as-Sayh	Lumps	Lumps of lime plaster encrusted with barnacles at only one side were interpreted as deriving from buildings abandoned due to inundation.
ARC-010	1 - Van de Velde (2015b); 2 - Connan and Carter (2007); 3 - McClure and al-Shaikh (1993)	Ain as-Sayh	Lumps	Bitumen lumps bore reed and fabric impressions, indicating use to caulk reed boats and/or waterproof matting within boats.
ARC-011	1 - Connan and Carter (2007); 2 - McClure and al-Shaikh (1993)	Ain as-Sayh	Lumps; Residues	Ceramic vessels contained accumulations of bitumen at their bases and running down their sides, indicating processing of bitumen for use. Geochemical analysis of one bitumen lump by Connan and Carter (2007) demonstrated its origin from Northern Iraq.
ARC-012	1 - Rollefson (2000); 2 - Rollefson, Simmons and Kafafi (1992); 3 - Rollefson, Kafafi and Simmons (1991); 4 - Rollefson (1990); 5 - Kingery, Vandiver and Prickett (1988); 6 - Rollefson and Simmons (1988); 7 - Rollefson (1986); 8 - Rollefson and Simmons (1986); 9 - Rollefson and Simmons (1985); 10 - Banning and Byrd (1984); 11 - Simmons and Rollefson (1984)	Ain Ghazal	Lumps; Residues	The walls and floors of buildings were plastered with lime or mud, which was frequently replenished. Lime plaster was predominantly utilised in the PPNB, whereas mud plaster was more frequent in the PPNC and Yarmoukian. A plaster ridge at the doorway of two rooms may have assisted drainage.
ARC-013	1 - Rollefson (1990); 2 - Rollefson and Simmons (1986)	Ain Ghazal	Residues	Storage bins were fixed to building floors using lime plaster.

ARC-014	1 - Olszewski (1994)	Ain Ghazal	Residues	A number of sickle blades bore traces of bitumen at their bases, sometimes with fragments of wood or bone adhering.
ARC-015	1 - Rollefson (1990); 2 - Rollefson and Simmons (1986)	Ain Ghazal	Lumps; Residues	The walls of storage pits were plastered with lime. The interior of storage bins was plastered with mud.
ARC-016	1 - Rollefson (1990); 2 - Rollefson and Simmons (1986)	Ain Ghazal	Residues	A number of ceramic sherds were thinly plastered. A shell was filled with plaster.
ARC-017	1 - Rollefson (2000); 2 - Rollefson, Simmons and Kafafi (1992); 3 - Rollefson, Kafafi and Simmons (1991); 4 - Rollefson (1990)	Ain Ghazal	Lumps	White ware vessels produced from plaster contained red staining indicative of decoration or use to hold liquid paint.
ARC-018	1 - Schmandt-Besserat (2013); 2 - Bonogofsky (2001); 3 - Grissom (2000); 4 - Rollefson, Schmandt-Besserat and Rose (1999); 5 - Griffin, Grissom and Rollefson (1998); 6 - Rollefson (1983)	Ain Ghazal	Residues	The eyes of plastered statues were painted black with bitumen. Plastered skulls had brighter white plaster applied to represent eyes, with pupils were painted on using bitumen.
ARC-019	1 - Schmandt-Besserat (2013); 2 - Bonogofsky (2001); 3 - Grissom (2000); 4 - Rollefson (2000); 5 - Rollefson, Schmandt-Besserat and Rose (1999); 6 - Griffin, Grissom and Rollefson (1998); 7 - Rollefson, Simmons	Ain Ghazal	Lumps; Residues	Caches of anthropomorphic statues produced from lime plaster moulded around reed bundle cores were recovered. Plastered skulls (often in a fragmentary state) were also recovered in caches, largely dating from the PPNB.

	and Kafafi (1992); 8 - Rollefson, Kafafi and Simmons (1991); 9 - Rollefson (1990); 10 - Simmons *et al.* (1990); 11 - Rollefson, Kafafi and Simmons (1989); 12 - Rollefson and Simmons (1985); 13 - Simmons and Rollefson (1984); 14 - Rollefson (1983)			
ARC-020	1 - Rollefson (2000); 2 - Rollefson, Simmons and Kafafi (1992); 3 - Rollefson, Kafafi and Simmons (1991); 4 - Rollefson (1990); 5 - Rollefson and Simmons (1985); 6 - Simmons and Rollefson (1984); 7 - Rollefson (1983)	Ain Ghazal	Lumps	Four pendants (three of which were engraved with parallel or converging lines) were produced from plaster, alongside fifteen geometric objects of indeterminate use (possibly gaming pieces). Anthropomorphic and zoomorphic figurines were also produced from plaster.
ARC-021	1 - Itkis *et al.* (2003); 2 - Kingery, Vandiver and Prickett (1988)	Ain Mallaha	Residues	The walls and floors of several buildings were plastered with lime. A brown bench-like structure was made from incompletely calcinated pure lime plaster.
ARC-022	1 - Büller (1983)	Ain Mallaha	Residues	Possible resin was used to fix eight lunates to bone/wood composite projectile points.
ARC-023	1 - Simmons (2012)	Ais Giorkis	Residues	The walls of buildings were plastered. A platform was plastered with crushed chalk mixed with water to produce a surface mimicking lime plaster.

ARC-024	1 - Šoberl *et al.* (2014)	Ajdovska Jama	Lumps	A small lump of tar was recovered near a burial. It may possibly have played a role as incense in funerary rites to mask the smell of decomposition.
ARC-025	1 - Roffet-Salque *et al.* (2015)	Ajdovska Jama	Microscopic	Beeswax was present on 4/25 sherds bearing residues (16% of total residues identified). This was noted as a high incidence of beeswax.
ARC-026	1 - Oras *et al.* (2017)	Akali	Microscopic	Traces of unidentified resin were identified on 6 sherds.
ARC-027	1 - Kingery, Vandiver and Prickett (1988); 2 - Hole and Flannery (1968)	Ali Kosh	Residues	The walls of buildings were plastered with clay, mud or gypsum and sometimes painted red with ochre. Bitumen was also utilised as a mortar for bricks and to seal roofs.
ARC-028	1 - Anderson (1994); 2 - Hole and Flannery (1968)	Ali Kosh	Residues	Bitumen was used to haft arrowheads, sickles and limestone celts used as hoes.
ARC-029	1 - Hole and Flannery (1968)	Ali Kosh	Residues	Hundreds of stone pebbles seem to have been used to stir or apply bitumen, sometimes with red ochre present as well.
ARC-030	1 - Gregg (2009); 2 - Gregg, Brettell and Stern (2007)	Ali Kosh	Residues	Bitumen was present on the interior face of pottery sherds, with uncertain use – either from sealing or bitumen transportation. Geochemical analysis indicated this bitumen derived from the Deh Luran source in Khuzestan.
ARC-031	1 - Gregg (2009); 2 - Hole and Flannery (1968)	Ali Kosh	Lumps	Reed impressions in bitumen lumps suggested use to waterproof basketry. Geochemical analysis indicated this bitumen derived from the Deh Luran source in Khuzestan.
ARC-032	1 - Hole and Flannery (1968)	Ali Kosh	Lumps	The non-perishable elements of pubic coverings were sometimes made from bitumen.
ARC-033	1 - Bánffy and Höhler-Brockmann (2020); 2 - Bánffy *et*	Alsónyék	Lumps	Significant quantities of burnt daub (2057.3kg of material) were recovered from pits and ditches - many bearing impressions from

	al. (2017); 3 - Kreiter, Pető and Pánczél (2013); 4 - Bánffy, Marton and Osztás (2010)			wooden planks and wattle indicating the presence of buildings and/or clay ovens. Impressions from diagonal beams and wooden boards indicated application to roofing. Analysis of three daub samples indicated the presence of feldspar/mica/quartz/vegetal temper.
ARC-034	1 - Elburg and Stäuble (2011)	Altscherbitz	Lumps	A chewed lump of tar was recovered. It was chewed either for medicinal purposes or to soften/moisten it for handling/use.
ARC-035	1 - Elburg and Stäuble (2011)	Altscherbitz	Residues	The exterior of a ceramic vessel was covered with tar to cover incised spiral decoration, then had three bands of birch bark placed around it. It had already seen sustained use with significant pitting attested beneath the tar, but then saw continued use afterwards due to sustained wear to pitch at the vessel base. A unique status is suggested for this vessel due to the elaborate decoration phases, repair and ultimate deposition in a well.
ARC-036	1 - Elburg and Stäuble (2011)	Altscherbitz	Residues	A ceramic vessel deposited into a well was repaired by passing cord through two holes to maintain its two halves, which were then sealed with tar.
ARC-037	1 - Rück (2001)	Am Wiesenberg	Microscopic; Residues	89 lithics bore traces of black/brown birch bark tar (58% of all tools from the site) on either their bases or backed edges.
ARC-038	1 - Urem-Kotsou *et al.* (2018)	Apsalos	Residues	12 pottery sherds deriving from tableware were repaired with birch bark tar. Nine of these sherds had animal fat incorporated into the tar. 1 of the 12 samples analysed was very well-preserved with hardly any degradation products suggesting low temperatures applied for tar extraction. Similar tar chromatograms suggested standardised production.

ARC-039	1 - Urem-Kotsou *et al.* (2018)	Apsalos	Residues	Ceramic sherds were painted with birch tar.
ARC-040	1 - Wojtczak *et al.* (2016); 2 - Jacomet, Leuzinger and Schibler (2003)	Arbon-Bleiche 3	Lumps	Lumps of burnt daub were uncovered alongside timbers from burnt buildings.
ARC-041	1 - Wojtczak *et al.* (2016)	Arbon-Bleiche 3	Residues	Lithics were hafted with birch tar.
ARC-042	1 - Médard (2003)	Arbon-Bleiche 3	Residues	The remains of two spindle disks bore traces of adhesive that fixed them in place.
ARC-043	1 - Reingruber (2005)	Argissa Magoula	Lumps	Lumps of burnt daub were recovered from pits.
ARC-044	1 - Eres and Özdoğan (2012)	Aşaği Pinar	Lumps	Large quantities (over 9000 pieces) of burnt daub representing a large proportion of buildings from the site were recovered. In some instances, pieces were fitted together to reconstruct architectural features.
ARC-045	1 - Charniauski *et al.* (2020)	Asaviec 2	Residues	4 bone fish hooks had traces of fastening adhesive remaining at their bases.
ARC-046	1 - Hauptmann and Yalcin (2000); 2 - Gourdin and Kingery (1975)	Aşıklı Höyük	Residues	Two samples of lime plaster deriving from floors contained aggregate content.
ARC-047	1 - Galili *et al.* (2013)	Atlit-Yam	Residues	Sickle blades were hafted with bitumen.
ARC-048	1 - Slah (2014a)	Aukštumala	Microscopic; Residues	2 bladelets bore dark adhesive residues, with one having only three small droplets present and the other hafted along its backed edge.

ARC-049	1 - Torchy and Gassin (2019)	Auriac	Residues	A triangular arrowhead was hafted with black adhesive.
ARC-050	1 - Stratouli *et al.* (2010)	Avgi	Residues	Wall plaster residues were present on mudbricks from collapsed buildings.
ARC-051	1 - Bocquentin and Garrard (2016)	Azraq 18	Residues	Strips of possible bitumen (or manganese) were applied to a cranium in a quadrangular pattern following the vault curves, over pinkish and yellow pigment residues.
ARC-052	1 - Stahlschmidt *et al.* (2017); 2 - Conard *et al.* (2013)	Baaz Rockshelter	Lumps	3 lumps of plaster coloured red with pigment were recovered within a building located within the rockshelter.
ARC-053	1 - Conard *et al.* (2013)	Baaz Rockshelter	Residues	Several blades were hafted with bitumen along their backed edges, many still set within hafts.
ARC-054	1 - Stahlschmidt *et al.* (2017); 2 - Conard *et al.* (2013)	Baaz Rockshelter	Lumps	A lump of lime plaster was recovered from a pit.
ARC-055	1 - Schlichtherle (2005)	Bad Buchau-Bachwissen I	Lumps	Lumps of chewed birch tar were recovered.
ARC-056	1 - Gebel and Kinzel (2007); 2 - Gebel, Hermansen and Kinzel (2006); 3 - Gebel and Hermansen (2005)	Ba'ja	Lumps; Residues	The floors of buildings and the bases of beds were plastered. Rubble from plastered roofs was also present inside buildings, bearing impressions from reed matting. Analysis of ceiling remnants identified clayey-silty material alongside charcoal and lime from recycled old plaster.
ARC-057	1 - Marinova (2017)	Bâlgarčevo	Lumps	Lumps of burnt daub recovered from a building were tempered with chaff and straw. Many bore impressions from wood or wattle.
ARC-058	1 - Chapple *et al.* (2009)	Ballintaggart	Residues	A flint blade was hafted with birch tar.

ARC-059	1 - Sørensen, Lübke and Groß (2018); 2 - Aveling and Heron (1999)	Barmose I	Lumps	22 chewed tar lumps were recovered, two of which had tooth imprints. One 5cm lump of brown/black tar had impressions from a child aged at least 11 – either to prepare the adhesive for use, or medicinal reasons.
ARC-060	1 - Kaal, Linderholm and Martínez Cortizas (2019)	Bastuloken	Microscopic	Soil contained high levels of totarol indicating the presence and likely use of a now deteriorated Cupressaceae resin.
ARC-061	1 - Tomasso *et al.* (2015)	Bazel-Sluis	Residues	Adhesive was present on the dorsal face of a flint microlith – with experiments suggesting the incorporation of charcoal from the smoother nature of its droplets.
ARC-062	1 - Rageot *et al.* (2021)	Beaurieux	Residues	Two lithics were hafted with birch tar.
ARC-063	1 - Moore (1978); 2 - Kirkbride (1968)	Beidha	Residues	The walls and floors of buildings were plastered with clay or lime. During earlier occupation, this tended to be a very sandy plaster, but greater lime content was present above Level IV. Hearths and open courtyards were also plastered.
ARC-064	1 - Moore (1978); 2 - Kirkbride (1968)	Beidha	Residues	Baskets were coated with either bitumen or lime plaster – for waterproofing or to make them rodent resistant.
ARC-065	1 - Bocquentin *et al.* (2014); 2 - Goren, Goring-Morris and Segal (2001); 3 - Goren and Goldberg (1991); 4 - Moore (1978)	Beisamoun	Residues	The floors of buildings were plastered. A handful of floors had reddish areas which might be traces of burning or pigmented areas. Plaster was largely of poor quality.
ARC-066	1 - Khalaily *et al.* (2015)	Beisamoun	Residues	3 stone bowls were coated with white plaster to rejuvenate them.

ARC-067	1 - Khalaily *et al.* (2015); 2 - Goren, Goring-Morris and Segal (2001); 3 - Moore (1978)	Beisamoun	Residues	2 plastered skulls were found beneath the floor of one building - one had a single layer of white pure lime plaster and the other consisted of a single layer of clay and lime plaster mixed with ash, calcite, ochre and silt to colour the plaster red without damaging the surface from its later application.
ARC-068	1 - Vouzaxakis (2001)	Belitsi Magoula	Lumps	Daub lumps were recovered, some bearing impressions from branches and reeds.
ARC-069	1 - Onfray (2020)	Bellevue	Lumps	Lumps of daub totalling 9.3kg in total were recovered from the ditches and pits of a ringed enclosure. These bore fingerprints and wattle impressions. 4 different daub compositions were identified. Some bore a surface coating of silty clay with sand and black organic matter. The components of all varieties originated from two formations within 1km of the site.
ARC-070	1 - Haller, Decavallas and Regert (2006)	Bercy	Microscopic	Beeswax was present on a number of ceramic sherds.
ARC-071	1 - Matthews *et al.* (2019); 2 - Godleman, Almond and Matthews (2016)	Bestansur	Residues	The walls of buildings were plastered with lime. Some were also painted red.
ARC-072	1 - Matthews *et al.* (2019); 2 - Godleman, Almond and Matthews (2016)	Bestansur	Residues	Bitumen was present on nine cut cowrie shells found in association with juvenile burials, especially skulls, suggesting use to adorn the head or mortuary wrappings.
ARC-073	1 - Casanova *et al.* (2020)	Bischoffsheim	Microscopic	Beeswax was present on 39/229 ceramic sherds identified as bearing residues (17% of total residues identified). These were mostly mixed with animal fats. 4 of these sherds also contained dairy products - 2 mixed with animal fats.

ARC-074	1 - Greenfield and Greenfield (2018); 2 - Greenfield, Greenfield and Jezik (2014); 3 - Greenfield (2000)	Blagotin	Lumps; Residues	The floors of two buildings were plastered. A platform located within a pit house was plastered. Clusters of daub lumps indicated the presence of buildings.
ARC-075	1 - Aveling and Heron (1999); 2 - Regnell *et al.* (1995)	Bökeberg III	Lumps	A small lump of black birch tar bore tooth impressions from an adult with a cavity in one tooth. It was either chewed or bitten to remove chunks for use.
ARC-076	1 - Hofmann *et al.* (2019)	Borđoš	Lumps	Daub lumps from buildings within an earthwork were recovered from the fill of its ditches.
ARC-077	1 - Mirković-Marić and Marić (2017)	Božina Peskara	Lumps	Daub lumps indicated the presence of a building.
ARC-078	1 - Roffet-Salque *et al.* (2015); 2 - Sauter *et al.* (2002)	Brunn am Gebirge	Microscopic	A terracotta female figurine had birch bark tar present in grooves at its hip. The grooves were likely made to improve tar adhesion. Additionally, beeswax was present on 4/9 ceramic sherds identified as bearing residues (25% of total residues identified).
ARC-079	1 - Haită (2001)	Bucşani	Lumps; Residues	The floors of buildings were plastered. Occasional lumps of burnt daub originating from building walls were recovered.
ARC-080	1 - Connan *et al.* (2005)	Burgan Hill	Residues	Bitumen was used to haft arrowheads and scrapers.
ARC-081	1 - Kingery, Vandiver and Prickett (1988)	Byblos	Residues	The floors of buildings were plastered with lime.
ARC-082	1 - Kingery, Vandiver and Prickett (1988)	Byblos	Residues	A layer of lime plaster mixed with calcite was present on a ceramic vessel.
ARC-083	1 - Soudský (1962)	Bylany	Residues	The walls of buildings were plastered.

ARC-084	1 - Brychova *et al.* (2021); 2 - Matlova *et al.* (2017)	Bylany	Microscopic	Lipid residue analysis of ceramic sherds detected abietic acid from altered pine resins, betulin from birch bark tar and friedelin from beech or oak tar.
ARC-085	1 - Soudský (1962)	Bylany	Residues	Storage pits were coated with plaster, which was replenished likely on an annual basis.
ARC-086	1 - Warren *et al.* (2018)	Caochanan Ruadha	Residues	A microlith bore a patch of possible black resin.
ARC-087	1 - Terradas, Clemente and Gibaja (2014)	Casa Montero	Residues	Ochre was present on the back of a sickle blade, suggesting use as an aggregate in a hafting adhesive.
ARC-088	1 - Haddow and Knüsel (2017)	Çatalhöyük	Residues	Bitumen was possibly added to carbon black used in a wall painting.
ARC-089	1 - Schotsmans *et al.* (2019); 2 - Çamurcuoğlu (2015); 3 - Anderson, Almond and Matthews (2014); 4 - Twiss *et al.* (2008); 5 - Arkun (2003); 6 - Kopelson (1996); 7 - Kingery, Vandiver and Prickett (1988); 8 - Mellaart (1967)	Çatalhöyük	Lumps; Residues	The walls and floors of buildings were plastered – both to enhance the interior environment and seal out the elements. Outdoor areas were rarely plastered. Plaster was often painted with anthropomorphic, geometric and zoomorphic designs. Decorative reliefs were also plastered. Some houses had up to 100 plaster coats applied over their use-life, likely replenished over a few months. A coarser brown preparatory coat was generally first applied, covered by a smoother white finish – the former to provide better adhesion for the finishing layer, which was purposefully selected for its whiteness, either for aesthetic reasons or to reflect/maximise light. In some areas, browner foundation plasters alone were utilised – kitchen areas and storage rooms. Lime plasters were utilised in earlier site levels, with most plaster types earthen in nature due to unburnt shells. Lumps of plaster indicate its frequent recycling.

ARC-090	1 - Martin and Russell (1996)	Çatalhöyük	Residues	Bitumen on the edges of a flat piece of antler shaped into a rounded rectangle, suggesting it was fitted to a haft.
ARC-091	1 - Arkun (2003)	Çatalhöyük	Residues	Thick layers of lime plaster present near pits and gullies in Space 181, alongside plaster lumps, was seen to indicate lime production and recycling.
ARC-092	1 - Roffet-Salque *et al.* (2015)	Çatalhöyük	Microscopic	Beeswax was present on 1/200 sherds identified as bearing residues (<1% of total residues identified). This identification was tentative due to a skewed chemical distribution, interpreted as resulting from sublimation due to aging or heat exposure.
ARC-093	1 - Çamurcuoğlu (2015); 2 - Mellaart (1967)	Çatalhöyük	Lumps; Residues	A plastered skull was recovered. White deposits on the surface of other bones were identified as gypsum plaster.
ARC-094	1 - Nardella *et al.* (2021); 2 - Nardella *et al.* (2019)	Catignano	Residues	Bitumen was used to haft 3 sickle blades and 2 bladelets. Geochemical analysis indicated this derived from local sources in Abruzzo.
ARC-095	1 - Gourdin and Kingery (1975)	Çayönü Tepesi	Residues	The wall of a building was plastered.
ARC-096	1 - Roffet-Salque *et al.* (2015)	Çayönü Tepesi	Microscopic	Beeswax was present on 2/9 sherds identified as bearing residues (22% of total residues identified). One of these sherds also bore traces of animal fat.
ARC-097	1 - Gregg (2009)	Chageh Sefid	Lumps; Residues	Bitumen was used to seal roofs and as a mortar for mudbricks.
ARC-098	1 - Gregg (2009); 2 - Gregg, Brettell and Stern (2007)	Chageh Sefid	Residues	Ceramic sherds had thin layers of dark brown or orange-brown adhesive presumed to be bitumen, adhering to their interiors, of uncertain purpose. These could be sealants or reflect bitumen

				transportation. Geochemical analysis indicated bitumen derived from the Deh Luran source in Khuzestan.
ARC-099	1 - Gregg (2009)	Chageh Sefid	Lumps	Impressions on bitumen lumps indicated use to seal basketry. Geochemical analysis indicated bitumen derived from the Deh Luran source in Khuzestan.
ARC-100	1 - Gregg (2009); 2 - Kingery, Vandiver and Prickett (1988)	Chageh Sefid	Lumps	2 white ware bowls were made from pure gypsum plaster.
ARC-101	1 - Roffet-Salque *et al.* (2015); 2 - Regert (2004); 3 - Chamot-Rooke (2001); 4 - Regert *et al.* (2001)	Chalain	Microscopic	Beeswax was present on 4 pottery sherds (15% of total residues identified). In one instance, it displayed an altered chemical profile resulting from either aging or heating and was mixed with animal fat. These residues may have resulted from culinary use (honey?), post-firing treatment of pottery vessels or medicinal usage.
ARC-102	1 - Roffet-Salque *et al.* (2015); 2 - Regert (2004); 3 - Chamot-Rooke (2001); 4 - Regert *et al.* (2001)	Chalain	Residues	Chemical analysis of adhesive residues from 40 arrowheads identified 20 as birch bark tar, 13 as an unidentified triterpenoid tar (not birch) and 2 as bitumen. One adhesive was a mixture of the unidentified triterpenoid tar with pine resin. 4 adhesives remained unidentified. Bitumen would have been a non-local adhesive deriving from the Neuchâtel area almost 70 miles distant. Differences in adhesive types and chromatograms indicates non-standardised adhesive production, likely varying according to individual usage.
ARC-103	1 - Gross-Klee and Hachuli (2002)	Cham-Eslen	Residues	A well-preserved axe was hafted with dark brown/black birch tar.
ARC-104	1 - Gross-Klee and Hachuli (2002)	Cham-Eslen	Residues	Strips of birch bark were glued with birch tar down the haft of a preserved axe in a spiral pattern.

ARC-105	1 - Onfray (2020)	Champ-Durand	Lumps	171 daub lumps (1.17kg) were recovered from the ditches of a ringed enclosure. These bore impressions from fingerprints, wood and wattle. 6 distinct daub compositions were identified. Components of all varieties originated from a location 2km away from the site.
ARC-106	1 - Roffet-Salque *et al.* (2015)	Chassey-le-Camp	Microscopic	Beeswax was present on 1/2 sherds identified as bearing residues (50% of total residues identified).
ARC-107	1 - Kabaciński *et al.* (2015)	Chełmiczki 10	Residues	An unidentified tar was used to paint a ceramic vessel, with pre-existing geometric engravings filled by a thin tar layer, while a layer of red ochre was added to the vessel exterior before tar application. This evened the surface and aided tar adhesion. Microscopic analysis identified a substantial quantity of sand added to improve paint adhesion and durability.
ARC-108	1 - Johnson *et al.* (2008)	Cheviot Quarry	Microscopic	3 ceramic sherds contained possible beeswax traces mixed with animal fats or plant oils.
ARC-109	1 - Anderson (1890)	Chevroux	Residues	Bitumen was used to haft flint knives and saws.
ARC-110	1 - Marschner *et al.* (1978)	Chogha Mish	Lumps; Residues	A pit/basin was lined with bitumen. 4 bitumen lumps were also recovered, one bearing impressions from plant matter. Another was present within a ceramic vessel. None of the lumps originated from local sources sampled for geochemical analysis.
ARC-111	1 - Mirabaud *et al.* (2015)	Clairvaux VII	Residues	3 ceramic vessels had their bases painted with brown birch tar. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.

ARC-112	1 - Mirabaud *et al.* (2015)	Clairvaux VII	Residues	Brown birch tar was used to fix decorations to 3 ceramic vessels. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.
ARC-113	1 - Mirabaud *et al.* (2015)	Clairvaux VII	Residues	A bone point was hafted with brown birch tar. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.
ARC-114	1 - Mirabaud *et al.* (2015)	Clairvaux VII	Residues	18 ceramic vessels were repaired with brown birch tar, sealing either the old fracture lines or repair holes drilled either side of the break through which cord was passed. Some vessels had repair holes lacking any adhesive, either because it wasn't always used or did not survive. Most of these vessels were bowls or cups (11% of the total) while vases and jars (2% of the total) were repaired less often, perhaps due to less intensive handling. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.
ARC-115	1 - Bontemps, Petrequin and Petrequin (2015); 2 - Mirabaud *et al.* (2015)	Clairvaux VII	Lumps	3 lumps of loose tar were recovered. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.
ARC-116	1 - Bontemps, Petrequin and Petrequin (2015); 2 - Mirabaud *et al.* (2015)	Clairvaux VII	Residues	A wooden comb was assembled with brown birch tar. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.

ARC-117	1 - Mirabaud *et al.* (2015)	Clairvaux XIV	Residues	2 ceramic vessels had their bases painted with brown birch tar. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.
ARC-118	1 - Mirabaud *et al.* (2015)	Clairvaux XIV	Residues	Brown birch tar was used to fix decorations to 2 ceramic vessels. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.
ARC-119	1 - Mirabaud *et al.* (2015)	Clairvaux XIV	Residues	A bone point was hafted with brown birch tar. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.
ARC-120	1 - Mirabaud *et al.* (2015)	Clairvaux XIV	Residues	29 ceramic vessels were repaired with brown birch tar, sealing either the old fracture lines or repair holes drilled either side of the break through which cord was passed. Some vessels had repair holes lacking any adhesive, either because it wasn't always used or did not survive. Most of these vessels were bowls or cups (15% of the total) while vases and jars (3% of the total) were repaired less often, perhaps due to less intensive handling. Traces of animal fat in adhesive from one repaired bowl might result from deliberate admixture or use of the bowl to prepare animal fats. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.

ARC-121	1 - Drieu *et al.* (2020); 2 - Roffet-Salque *et al.* (2015)	Clairvaux XIV	Microscopic	Beeswax was present on 5/45 sherds identified as bearing residues (12% of total residues identified) in one study. Another identified beeswax in 10/397 vessels (mainly small cups), 4 of which also contained animal fat or dairy products. It was suggested beeswax in small cups indicated waterproofing of these vessels, which were then used to consume animal products, with the interior of a large vessel containing beeswax with no indications of heating suggested to indicate waterproofing to store liquids or storage of beeswax itself. Sherds from 2 large cooking pots also contained heavily degraded beeswax alongside a variety of other residues (dairy, animal fats and plant oils).
ARC-122	1 - Mirabaud *et al.* (2015)	Clairvaux XIV	Lumps	2 tar lumps were recovered, one of which was mixed with beeswax. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.
ARC-123	1 - Drieu *et al.* (2020)	Clairvaux XIV	Residues	Unidentifiable traces of birch tar were present on two ceramic sherds, used in either decorating or repairing. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.
ARC-124	1 - Mirabaud *et al.* (2015)	Clairvaux XIV	Residues	A wooden comb was assembled with brown birch tar. The tar was moderately degraded from heating at medium-high temperatures. The homogenous nature of tar chromatographs indicated standardised production.

ARC-125	1 - Barclay, Brophy and MacGregor (2002)	Claish Farm	Lumps	Heavily burnt daub was recovered from the interior of a building.
ARC-126	1 - Little (2014)	Clonava I	Residues	A resinous substance was noted on a number of flakes and blades, possibly pine given its predominance in the region.
ARC-127	1 - Nardella *et al.* (2021); 2 - Nardella *et al.* (2019)	Colle Cera	Residues	Bitumen was present on 13 blades - 7 of them sickle blades.
ARC-128	1 - Casanova *et al.* (2020)	Colmar	Microscopic	Beeswax was present on 6/192 potsherds (3% of total residues identified).
ARC-129	1 - Anderson (1890)	Concise-sous-Colachoz	Residues	Flint saw blades were fixed to their wooden hafts with bitumen.
ARC-130	1 - Rampazzi *et al.* (2007)	Corongiu	Residues	Analysis of a paint sample from geometric motifs (horns, spirals, concentric circles and bands) showed use of haematite pigment with egg and conifer resin as a binder. Result values placed the egg glue midway between egg and animal glues, but this was attributed to bacterial contamination.
ARC-131	1 - Vouga (1928)	Cortaillod	Residues	A strip of black bitumen incised with a double row of "wolf's teeth" partially filled with red ochre was present around the neck of a pottery sherd.
ARC-132	1 - Salisburg, Bertók and Bácsmegi (2013)	Csárdaszállás 8	Lumps	Pieces of burnt daub were recovered indicating the position of buildings.
ARC-133	1 - Tarifa-Mateo *et al.* (2019)	Cueva de El Toro	Microscopic	Two pottery sherds bore traces of pine resin alongside porcine and ruminant animal fats. These may result from waterproofing before processing or storage of animal fats.
ARC-134	1 - Rimkus (2018)	Daktariškė 5	Microscopic; Residues	Two arrowheads bore tar residues, but only one could be examined microscopically due to burning.

ARC-135	1 - Robson *et al.* (2019)	Daktariškė 5	Microscopic	Traces of birch bark tar, some mixed with animal fat, were detected on 12 ceramic sherds. Two examples from crusts at the exterior base of two vessels were suggested to originate incidentally from fuel used to heat vessel contents rather than deliberate application.
ARC-136	1 - Butrimas (2018); 2 - Butrimas (2016)	Daktariškė 5	Residues	The obverse of a pierced amber disk found in a burial had pitted dots forming both a large cross leading to its centre and triangular designs around its edges, while the reverse had eight engraved triangles filled with smaller crossing lines. It measured 3.6cm in diameter. Chemical analysis demonstrated dark brown or black material filling the pits on the obverse was comprised of either conifer resin (likely pine resin), beeswax and charcoal, while red material filling the engraved triangles on the reverse consisted of adhesive red clay. The darker colour of the adhesives contrasted against the lighter amber material. The disk was then polished with leather or equisetum. It could have been used as a pendant with string passed through the centre, perhaps for symbolic purposes representing the sun or as a calendar.
ARC-137	1 - Teoh, McClure and Podrug (2014)	Danilo Bitinj	Lumps	Samples of daub from the site were analysed.
ARC-138	1 - di Lerna *et al.* (1995)	Defensola A	Residues	The walls of mine galleries were plastered to contain debris and make navigation easier.
ARC-139	1 - Connan *et al.* (2006)	Demirköy Höyük	Lumps	A cigar-like object made from bitumen was also recovered.
ARC-140	1 - Connan *et al.* (2006)	Demirköy Höyük	Lumps	Chemical analysis demonstrated two black/grey-black semi-circular ring-like objects measuring a few centimetres across were made from bitumen deriving from a source similar to the nearby Bogazkoy oil

				seep. Either the bitumen derived from a nearby source, the Bogazkoy seep had different chemical properties in the Neolithic or weathering affected molecular composition of the artefacts. The presence of sand may be unintentional or deliberate.
ARC-141	1 - Vergély, Gandelin and Garnier (2012)	Devèze-Sud	Microscopic	A ceramic vessel contained traces of degraded conifer resin, animal fat and plant oil.
ARC-142	1 - Marangou and Stern (2009); 2 - Decavallas (2007)	Dikili Tash	Residues	Chemical analysis of 5 zoomorphic pottery vessels identified various substances - lignite, sesquiterpenoids indicating either cedar/cypress/juniper resin, fatty acids either deriving from plant oils or animal fats and possible beeswax in varying combinations on their interior and exterior surfaces. The first and third contained resin and lignite, the fifth lignite alone and the second and fourth contained a mixture of all substances, except potential beeswax residues which were present in the fourth alone. These vessels could have been used as lamps (zoomorphic elements as potential handles, interiors capable of holding sufficient fuel for an hour, two had heavily blackened interiors) with residues on exterior surfaces deriving from leakage or incense burners. They could also have been used as incense burners for fragrance/smoke although they would have been more suitable in an outdoor environment, or fumigators utilising the antibacterial/insecticidal properties of the resin for cleanliness or to preserve goods/food in the storage areas of the buildings in which they were found. They could have had a medicinal role from antimicrobial/antifungal properties. They also could have been used for storage of materials. The resin itself might have held symbolic

				value in protecting inhabitants and their possessions and if it did derive from cedar, it might have been valued for its rarity as well, as it would have been imported from Turkey/Cyprus/Lebanon. However, it could also derive from cypress or juniper, the latter of which was located in the immediate site area.
ARC-143	1 - Roffet-Salque *et al.* (2015)	Dikili Tash	Microscopic	Analysis of a perforated pottery sherd originating from the base of a large vessel yielded traces of beeswax degraded from heating and a later study found that beeswax was present on 1 out of 14 sherds identified as bearing residues (7% of total residues present).
ARC-144	1 - Garnier and Valamoti (2016)	Dikili Tash	Microscopic	Further analysis of a fragmentary jar identified traces of resin associated with grape traces indicating waterproofing of the vessel prior to its use to ferment wine.
ARC-145	1 - Porčič (2012)	Divostin	Lumps	Pieces of burnt daub represented the remains of two buildings.
ARC-146	1 - Pichon (2017)	Dja'de-el-Mughara	Microscopic; Residues	Several sickle blades had traces of brown or black adhesive on their backed edges, likely bitumen.
ARC-147	1 - Pichon (2017)	Dja'de-el-Mughara	Lumps	Small micro-fragments of bitumen were also recovered from sediment flotation.
ARC-148	1 - Pelisiak (2015)	Dobroń	Lumps	Two rectangular concentrations of daub were interpreted as the remains of two buildings.
ARC-149	1 - Anastassova (2008)	Dobroslavtsi	Lumps	A number of fired lumps of wall plaster were recovered within the foundations of a building.
ARC-150	1 - César González-García *et al.* (2018)	Dombate	Residues	Orthostats in the chamber and corridor of a passage grave were regularised with white plaster made from kaolinite and water,

				probably with additional organic adhesive. Geometric patterns in red and black were painted over this layer.
ARC-151	1 - Kansa *et al.* (2009)	Domuztepe	Lumps	Remains of plastered baskets were unearthed alongside other artefacts, animal bones and human bones with features indicating cannibalism from a feature known as the "Death Pit".
ARC-152	1 - Ray and Thomas (2020)	Dorstone Hill	Lumps; Residues	Masses of daub incorporating cow dung were present at the core of three long barrows, representing former buildings.
ARC-153	1 - Van de Velde (2015a); 2 - Van de Velde *et al.* (2015)	Dosariyah	Lumps	244 bitumen objects were recovered, mostly plain featureless lumps. Some bore reed impressions that might indicate use in architecture or basketry and a small number were formed into small bowl shapes. Reed impressions likely do not derive from boat caulking due to no evidence of barnacles and their wide distribution across the site. Some contained inclusions of sand, crushed shell and small pebbles, but due to their quantity are likely to be unintentional contaminants. Bitumen is uncommon in the Gulf region and chemical analysis of 20 samples indicated their origin in Northern Mesopotamia and Kuwait as imports.
ARC-154	1 - Van de Velde (2015a); 2 - Van de Velde *et al.* (2015)	Dosariyah	Lumps	15 bitumen stoppers/plugs were likely used to seal containers.
ARC-155	1 - Van de Velde (2015a); 2 - Van de Velde *et al.* (2015)	Dosariyah	Lumps	244 bitumen objects were recovered, mostly plain featureless lumps.
ARC-156	1 - Van de Velde (2015a); 2 - Van de Velde *et al.* (2015)	Dosariyah	Lumps	A small number of bitumen objects were formed into small bowl shapes.
ARC-157	1 - Karkanas and Stratouli (2008); 2 - Stratouli (2005)	Drakaina Cave	Residues	Several plaster floors were constructed in the cave consisting of a mixture of lime plaster, clay and limestone fragments with smaller

				quantities of quartz fragments, feldspars, mica flakes and fine charcoal. In most instances, incompletely calcinated limestone fragments comprised 30-40% of the mixture. Most were white, but some were tinted red or grey. Lumps of lime in plaster mixtures is attributed to dry slaking of lime with water, followed by poor mechanical combination.
ARC-158	1 - Rimkus (2018)	Dreniai	Microscopic	One arrowhead used in hunting bore traces of "tar" adhesive.
ARC-159	1 - Urem-Kotsou *et al.* (2018)	Drenovac	Residues	Five ceramic sherds were repaired using mixtures of birch bark tar with animal fat or birch bark tar with animal fat and pine resin. The diverse nature of tar chromatographs indicated less standardised production methods. The minimal alteration of the pine resin utilised suggested it was melted at low temperatures before application.
ARC-160	1 - Roffet-Salque *et al.* (2015)	Drenovac	Microsopic	Another study found beeswax to be present on 2 out of 33 sherds identified as bearing residues (6% of total residues present).
ARC-161	1 - Urem-Kotsou *et al.* (2018)	Drenovac	Residues	One ceramic sherd was waterproofed with pure birch tar. The diverse nature of tar chromatographs indicated less standardised production methods.
ARC-162	1 - Obelić *et al.* (2004)	Dubovo-Košno	Lumps	Fragments of clay plaster from building walls were recovered.
ARC-163	1 - Spataro (2006)	Dudeştii Vechi	Lumps	Three fragments of burnt daub were recovered from the site.
ARC-164	1 - Parker Pearson *et al.* (2011)	Durrington Walls	Lumps; Residues	Pieces of daub and the remains of a chalk matrix were interpreted as the remains of a wall incorporating both chalk plaster and wattle-and-daub.

ARC-165	1 - Mukherjee, Gibson and Evershed (2008)	Durrington Walls	Microscopic	Beeswax was present on 3 out of 155 pottery sherds bearing residues (<2% of total residues). One of these consisted of heavily degraded beeswax mixed with dairy fat. The remainder of the assemblage consisted of various animal fats and plant waxes.
ARC-166	1 - Mencke (1934)	Duvensee	Lumps	A microlith was also attested with birch bark tar adhering to its base and tip.
ARC-167	1 - Bokelmann (2012)	Duvensee	Lumps	A lump of birch bark tar with tooth imprints was recovered from site 11.
ARC-168	1 - Møbjerg (2012)	Dværgebakke I	Lumps	Three small lumps of birch bark tar with tooth imprints were recovered in close proximity to each other, all chewed by children either to assist adults by preparing the tar for use or for medicinal/hygenic reasons. One of the pieces only bore imprints on one side and one of them had been chewed by someone with a missing tooth.
ARC-169	1 - Alexandrova, Kireeva and Leonova (2014)	Dvoinaya Cave	Residues	Thirty-eight lithics had adhesive traces ranging in colour from translucent light yellow to opaque dark brown and red located at their bases. A small number of these formed coloured stripes in brown or dark grey about 1-2mm wide. Impressions of plant fibres were present on some residues. Two samples taken from an arrowhead indicated a mixture of conifer resin, animal protein, coarse calcite and red-brown clay but differed in that one indicated polysaccharides possibly from a fruit gum or juice. One of the samples also suggested the presence of coal, while the other suggested quartz. Another two samples from a notched tool indicated conifer resin, but differed again in that one indicated animal protein and the other

				polysaccharides. A scraper had traces of animal protein, possible animal lipids, calcite and coal. A blade had conifer resin, calcite and red-brown clay. Samples differed again, with one indicating no additional components beyond the above, another suggesting animal protein and a third indicating polysaccharides.
ARC-170	1 - Pike-Tay *et al.* (2004)	Ecsegfalva 23	Lumps	Pieces of daub bore reed impressions from building walls.
ARC-171	1 - Petersen (2021)	Egemarke	Residues	The head of an amber elk figurine ornamented with zigzags/chevrons had the remains of black adhesive - probably birch bark tar - on the surface of a break and two boreholes at the neck through which cord was probably passed through.
ARC-172	1 - Gibaja *et al.* (2017); 2 - Vogt (1949)	Egolzwil 3	Residues	Pottery sherds also bore patterns of birch bark cut and fixed onto the vessels with bands of birch bark tar.
ARC-173	1 - Gibaja *et al.* (2017); 2 - Vogt (1949)	Egolzwil 3	Residues	Six blades and one flake used to cut plant material had black adhesive residue at their bases. Most of the blades were still fixed in their wooden hafts.
ARC-174	1 - Oliveira *et al.* (2017)	Eireira	Residues	Red and white geometric designs (circles, lines and dots) painted on a pillar within a tumulus were painted with haematite/kaolinite suspended in a binder characteristic of algae or other aquatic plants, probably algin, with painted dots also incorporating egg glue.
ARC-175	1 - White and Makarewicz (2012); 2 - Makarewicz and Austin (2006); 3 - Makarewicz *et al.* (2006); 4 - Makarewicz and Goodale (2004)	el-Hemmeh	Lumps; Residues	The walls and floors of buildings were coated with plaster, which was sometimes painted red. Fragments of burnt daub were also recovered from the walls of a structure.

ARC-176	1 - Makarewicz and Austin (2006); 2 - Makarewicz *et al.* (2006); 3 - Makarewicz and Goodale (2004)	el-Hemmeh	Lumps; Residues	A deep LPPNB pit and bins used for storing cereals were lined with plaster.
ARC-177	1 - Toffolo *et al.* (2017)	el-Khirbe	Microscopic; Residues	Chemical and microscopic analysis indicated a small sinkhole was used as a lime production kiln, with lime residues present heated at very high temperatures.
ARC-178	1 - Moore (1978)	el-Kum	Residues	The floors and walls of houses were coated with white plaster or clay plaster mixed with fragments of red burnished plaster.
ARC-179	1 - Casanova *et al.* (2020)	Ensisheim	Microscopic	Pure beeswax was present on 3 out of 101 pottery sherds identified as bearing residues (3% of total residues present) with a further 5 sherds displaying animal fats mixed with beeswax or plant wax residues (5% of total residues present). Dairy fats were detected on 19 sherds (19% of total residues) and animal fats on 45 sherds (45% of total residues).
ARC-180	1 - Svobodová (2014)	Ensisheim	Residues	Two mussel shells fixed at the end of a decorated bone (possibly a doll or statue) were filled with black adhesive (probably resin) to resemble eyes.
ARC-181	1 - Ottaway (1992)	Ergolding Fischergasse	Residues	A number of blades from the site also had tar residues along their lateral edges.
ARC-182	1 - Ottaway (1992)	Ergolding Fischergasse	Residues	Thick carbonised crusts of tar on the inside of vessels probably derive from tar production.
ARC-183	1 - Heron, Nemcek and Bonfield (1994)	Ergolding Fischergasse	Residues	Another sixty adhesive traces, either as residues on the interior or exterior of pottery sherds or masses of material, were identified as mostly birch bark tar deriving from Betula pendula. Some, however, were identified as deriving from a softwood, likely pine bark tar.

				These residues indicated a variety of uses - including repairing pottery.
ARC-184	1 - Heron, Nemcek and Bonfield (1994)	Ergolding Fischergasse	Residues	A pottery sherd bore traces of pure beeswax brown-black in colour, thin and glossy. This was heavily degraded from heating at high temperatures until discoloured into a brown-black mass. It was likely utilised to waterproof the vessel to hold liquids or storage of beeswax within the vessel.
ARC-185	1 - Heron, Nemcek and Bonfield (1994)	Ergolding Fischergasse	Lumps	Various chewed pieces of tar were recovered.
ARC-186	1 - Evans and Heron (1993); 2 - Ottaway (1992); 3 - Heron *et al.* (1989)	Ergolding Fischergasse	Residues	A number of ceramic sherds bore traces of black birch bark tar, with two bearing traces of pine bark tar, on their interior and/or exterior surfaces. One bore traces of beeswax on its interior.
ARC-187	1 - Heron, Nemcek and Bonfield (1994)	Ergolding Fischergasse	Residues	Another sixty adhesive traces, either as residues on the interior or exterior of pottery sherds or masses of material, were identified as mostly birch bark tar deriving from Betula pendula. Some, however, were identified as deriving from a softwood, likely pine bark tar. These residues indicated a variety of uses - including waterproofing.
ARC-188	1 - Copley *et al.* (2005)	Eton Rowing Lake	Microscopic	Traces of beeswax were detected on five pottery sherds (2 samples were pure beeswax, 2 were mixtures of beeswax and animal fat and 1 was a mixture of beeswax and dairy products).
ARC-189	1 - Spataro (2006); 2 - Jongsma (1997)	Foeni-Sălaş	Lumps; Residues	The floors of buildings were plastered with clay. Pieces of burnt daub from building walls, kilns and ovens were recovered as surface concentrations and from pits. Six varieties of adhesive composition were attested - clay with small sand particles, clay with small sand particles and silt, clay with silt; clay with shell, clay with large sand

				particles and clay with chaff. Daub identified as originating from building walls had greater proportions of chaff.
ARC-190	1 - Roffet-Salque *et al.* (2015)	Font-Juvénal	Microscopic	Beeswax present on 2 out of 15 pottery sherds identified as bearing residues (13% of total residues present).
ARC-191	1 - Mazzucco *et al.* (2018)	Fornace Capuccini	Residues	Bitumen residues were present on a sickle blade.
ARC-192	1 - Ritter (2013)	Friedberg B3a Km 19	Residues	Black adhesive was utilised to haft a number of lithics.
ARC-193	1 - Ritter (2013)	Friedberg B3a Km 19	Residues	Black adhesive was utilised to repair a number of ceramic sherds.
ARC-194	1 - Ritter (2013)	Friedberg B3a Km 19	Residues	Black adhesive was utilised to waterproof a number of ceramic sherds. Residues were present on the interior and exterior of these sherds.
ARC-195	1 - Yates *et al.* (2015)	Friesack	Residues	Dark brown / black adhesive residues were present on a fragmentary flint flake. These could have been bitumen since they provided an older radiocarbon date.
ARC-196	1 - Roffet-Salque *et al.* (2015)	Ftélia	Microscopic	Beeswax was present on 4 out of 9 sherds identified as bearing residues (44% of total residues present).
ARC-197	1 - Veronika and György (2007); 2 - Domboróczki (2001)	Füzesabony-Gubakút	Lumps	Pieces of burnt daub, likely taken from building walls, were recovered from refuse pits and infilled wells.
ARC-198	1 - Riel-Salvatore, Lythe and Uribe Albornoz (2021)	Ganj Dareh Tepe	Residues	The floors and walls of buildings were plastered with mud.
ARC-199	1 - Vaughan (1984)	Gazel	Residues	Adhesive residues were present on a fragmentary flint flake.

ARC-200	1 - Shaham, Grosman and Goren-Inbar (2010)	Gesher	Residues	A flint crescent had red-coloured clay plaster containing a number of other elements present on its backed edge. The adhesive had been applied over a layer of vegetal material covering the flint to provide friction between the two. A lack of burning indicated the plaster had been heated at low temperatures, probably on hot coals or the fringes of a hearth.
ARC-201	1 - Gervasoni (1999)	Ghwair I	Residues	The floors and parts of the walls of houses were plastered with red plaster, with the exception of some rooms possibly used for storage. Gullies were cut into plastered floors, perhaps to carry away water. Bodies were interred beneath plastered floors. A plaster bench was also attested.
ARC-202	1 - Goren and Goldberg (1991)	Gilgal I	Residues	The walls of buildings were plastered with clay or mud. A possible oven or hearth was also plastered.
ARC-203	1 - Dag *et al.* (2010)	Gilgal I	Residues	22 lithics were hafted with black adhesive, probably bitumen. These included an axe hafted with adhesive at its centre. 21 were hafted laterally but one was hafted proximally.
ARC-204	1 - Noy (1989)	Gilgal I	Lumps	Two fragments of asphalt were found attached to a long burnt piece of wood.
ARC-205	1 - Bar-Yosef *et al.* (2010); 2 - Noy (1989)	Gilgal I	Lumps	Impressions indicate another three bitumen lumps seem to have been part of a cordage basket.
ARC-206	1 - Noy (1989)	Gilgal I	Residues	Eyes were painted on with black paint, likely bitumen, on a burnt clay human figurine.
ARC-207	1 - Dag and Goring-Morris (2010)	Gilgal II	Residues	Two sickle blades bore traces of an adhesive along their backed edges, probably bitumen.

ARC-208	1 - Binder *et al.* (1990)	Giribaldi	Residues	Some bone tools also bore similar hafting residues, some of which were carbonised. Chemical analysis demonstrated these all consisted of birch bark tar. The tar varied in degradation levels, with some slightly degraded from heating at low temperatures, while others were heavily degraded from exposure to higher temperatures. Experimental data indicated varying production methods, with some of the tar was produced via a double chamber method from the presence of fatty acids, diacids and betulinic acids while other well-preserved residues lacking these elements indicated a single chamber method.
ARC-209	1 - Rageot *et al.* (2019); 2 - Regert (2004)	Giribaldi	Lumps	30 small lumps of yellow-brown or black-brown adhesive were attested, with either glossy or cracked surfaces.
ARC-210	1 - Takaoğlu *et al.* (2014)	Girmeler Cave	Lumps; Residues	The floor of a building was plastered with lime. The remains of wattle-and-daub walls were also preserved.
ARC-211	1 - Dietrich, Notroff and Dietrich (2018); 2 - Dietrich and Schmidt (2010)	Göbekli Tepe	Residues	The walls of circular enclosures were plastered with a mixture of loam and charcoal.
ARC-212	1 - Davies (2009)	Gorhambury	Lumps	Pieces of daub were recovered from buildings.
ARC-213	1 - Kalafatič, Klindžíc and Šiljeg (2020)	Gorjani-Kremenjača	Lumps	Several layers of burnt daub and charcoal associated with postholes indicated repeated rebuilding of a structure.
ARC-214	1 - Szakmány *et al.* (2019)	Gorzsa	Lumps	Lumps of burnt daub containing vegetal matter originating from buildings were analysed to examine their composition compared with ceramics.

ARC-215	1 - Alakbarov (2018); 2 - Alakbarov (2015)	Göytepe	Residues	A small number of vessel rims (0.5% of the total ceramic assemblage, or several) were painted with narrow bands of bitumen.
ARC-216	1 - Nishiaki *et al.* (2018)	Göytepe	Residues	A limited number of houses were plastered with mud.
ARC-217	1 - Alakbarov (2018); 2 - Alakbarov (2015)	Göytepe	Residues	A number of flint tools were also hafted with bitumen.
ARC-218	1 - Alakbarov (2015)	Göytepe	Residues	Bitumen was present as thick or thin crusts at the base of jars, suggesting processing or storage.
ARC-219	1 - Alakbarov (2018); 2 - Alakbarov (2015)	Göytepe	Residues	Other vessels had bitumen residues on their exteriors from repairs or waterproofing.
ARC-220	1 - Mirković-Marić and Marić (2017)	Gradište	Lumps; Residues	The floors and walls of buildings were plastered with daub. Considerable pieces of daub were present on the floors of buildings.
ARC-221	1 - Nicod *et al.* (2012); 2 - Chesnaux (2009)	Grande Rivoire	Residues	Faint black spots of residue present on lithics may represent a hafting adhesive.
ARC-222	1 - Rimkus (2018)	Gribaša 4	Microscopic	Tar residues were present on three arrowheads used in hunting.
ARC-223	1 - Pennetta *et al.* (2020)	Grotta dei Cervi	Residues	Black bitumen was used in repairing five pottery sherds. Geochemical analysis indicated the bitumen derived from both Italy and Albania.
ARC-224	1 - Nardella *et al.* (2019)	Grotta dei Piccioni	Residues	Geochemical analysis of bitumen residues present on two pottery sherds indicated they derived from a nearby source in Abruzzo.
ARC-225	1 - Courel *et al.* (2020)	Grube-Rosenhof	Microscopic	Chemical analysis indicated several vessels contained lupane and abietic acid derivatives, indicating the presence of birch or pine products (resin or tar). Beeswax residues were also present on one sherd.

ARC-226	1 - Diana *et al.* (2019); 2 - Boroneanţ (2012)	Grumăzeşti	Lumps	Small pieces of burnt daub bearing impressions from wattle were uncovered in agglomerations representing collapsed buildings.
ARC-227	1 - Kabukcu *et al.* (2021)	Gusir Höyük	Residues	The floors and walls of buildings were plastered.
ARC-228	1 - Connan *et al.* (2005); 2 - Carter and Crawford (2003); 3 - Carter (2002a); 4 - Carter (2002b); 5 - Carter and Crawford (2002); 6 - Carter and Crawford (2001)	H3	Lumps	77 bitumen fragments ranging from 0.5-2cm thick were attested, with 34 better-preserved examples forming straight geometric slabs. Most of these were found in buried caches within a central circular building and were highly friable from decay of vegetal material incorporated into them. The majority bore reed impressions at one side, with barnacles only present at the opposite side. Those without barnacles were interpreted as coating applied above the water line. Four bore rope/string impressions likely from lashings used to tie reed bundles together to form a hull and small holes perhaps indicative of post-depositional disturbance or marine-boring organisms perhaps prompting removal in the first place. Nine fragments bore no impressions. It was suggested they represented a coating applied to the hull of reed-bundle boats as a waterproofing and anti-fouling agent removed from old or damaged vessels and stored for repair or recycling (either as new coating or for other uses). This was based on ethnographic and later archaeological evidence of such coatings and a clay model of a reed-bundle boat also found at H3. Layers of bitumen-reeds-bitumen were interpreted as repairs of coating while the boats were still in use. The bitumen used was mixed with vegetal matter (about 18% on average) with mineral aggregates like sand, crushed shell and possibly clay also added to prevent it from sweating

				in high ambient temperatures, reduce the amount of bitumen needed, add greater flexibility/strength and enable handling and application at lower temperatures. Barnacle fragments were also present within bitumen, likely from previous recycling stages. Geochemical analysis indicated the bitumen used derived from the Burgan Hill source in Kuwait. Bitumen use increased continually at the site until Period 4 when falling sea levels cut off direct access to the sea.
ARC-229	1 - Connan *et al.* (2005)	H3	Lumps	Other uses for bitumen were evident, with a champagne-cork shaped piece interpreted as a stopper for a container, with a hole present through it interpreted as having held string for its extraction.
ARC-230	1 - Nishiaki *et al.* (2013)	Hacı Elamxanlı Tepe	Residues	A flint sickle blade bore bitumen residues.
ARC-231	1 - Kingery, Vandiver and Prickett (1988); 2 - Mellaart (1970)	Hacilar	Lumps; Residues	The floors and walls of buildings were plastered with clay, lime or mud. One study identified use of lime plaster mixed with mineral aggregate to plaster a floor.
ARC-232	1 - Vardi and Gilead (2013)	Hagoshrim IV	Residues	A flint tool bore traces of white plaster used in hafting.
ARC-233	1 - Estreicher (2006); 2 - McGovern *et al.* (1996)	Hajji Firuz Tepe	Residues	Six pottery vessels contained wine traces in combination with yellowish residues from Pistacia atlantica (or terebinth) resin on their interior surfaces - to prevent bacteria growth and spoiling but possibly also to assist in waterproofing the vessel.
ARC-234	1 - Thuesen and Gwozdz (1982)	Hama M	Lumps	Chemical analysis of 4 samples of wall plaster (some painted red-brown or red-orange) indicated use of lime plaster. 2 samples of stucco work consisted of gypsum plaster.

ARC-235	1 - Thuesen and Gwozdz (1982)	Hama M	Residues	1 sample of white plaster coated the rim of a ceramic bowl indicated production/use of lime plaster.
ARC-236	1 - Nativ *et al.* (2014)	Hanaton	Residues	A later pottery Neolithic layer contained a depression was coated with mud plaster applied over a layer of small stones.
ARC-237	1 - Nativ *et al.* (2014)	Hanaton	Residues	One PPNB sickle blade bore adhesive traces.
ARC-238	1 - Séara *et al.* (2010)	Hangest-sur-Somme	Residues	Microliths bore traces of black adhesive "resin" in retouched areas on their edges.
ARC-239	1 - Vardi, Yegorov and Eisenberg-Degen (2014)	Har Harif	Residues	An axehead bore traces of adhesive.
ARC-240	1 - Wierer *et al.* (2018); 2 - Sauter *et al.* (2000)	Hauslabjoch	Residues	A copper hatchet and two flintstone arrowheads were hafted with birch tar.
ARC-241	1 - Bar-Yosef (1991); 2 - Kingery, Vandiver and Prickett (1988); 3 - Bar-Yosef (1983)	Hayonim	Residues	A layer of thick crumbly, incompletely calcinated lime plaster was present in a hearth/kiln.
ARC-242	1 - Stika (1996)	Heilbronn-Klingenberg	Lumps	Pieces of burnt daub mixed with chaff were recovered from several pits and/or ditches.
ARC-243	1 - Pawlik (2004)	Henauhof-Nord II	Residues	Birch bark tar was identified on a number of lithics. Although ash was present, this was interpreted as incidental resulting from preparation.
ARC-244	1 - Pawlik (2004)	Henauhof-Nord II	Lumps	A piece of birch bark wrapped around a central core of clay and small pebbles was interpreted as a preparation for tar production.
ARC-245	1 - Dubreuil *et al.* (2019); 2 - Grosman and Munro (2016); 3 - Munro and Grosman (2010); 4 -	Hilazon Tachtit	Lumps; Residues	The grave of a female shaman was plastered with mud that was embedded with five limestone slabs. Lumps of clay included in the grave fill might have been leftover from plastering. A broken basalt

	Grosman, Munro and Belfer-Cohen (2008)			tool used to stir pyrogenic calcite (either wood ash or lime plaster) was included in the burial.
ARC-246	1 - Prokeš *et al.* (2009-2010)	Horákov	Residues	Two flint blades bore birch bark tar residues, although one had an insufficient amount of material to permit chemical analysis. The tar was moderately degraded from heating at low temperatures.
ARC-247	1 - Schlichtherle (1981)	Hornstaad-Hörnle I	Residues	Pure birch bark tar was used to haft arrowheads and other lithics.
ARC-248	1 - Fuchs and Wahl (2013); 2 - Schlichtherle (1981)	Hornstaad-Hörnle I	Lumps	110 chewed brown lumps of pure birch bark tar were analysed. They were chewed by people of different ages - mostly by young adults (17-25) with very few children chewing.
ARC-249	1 - Fuchs and Wahl (2013)	Hornstaad-Hörnle I	Lumps	Other lumps of tar showed traces of cords, plant fibers and surfaces indicating use to seal baskets, bags or shoes. Other pieces were rolled into balls, coils or slightly flatenned lumps.
ARC-250	1 - Fuchs and Wahl (2013)	Hornstaad-Hörnle I	Lumps	One lump of tar was rolled lengthways and perforated in the middle, perhaps for attaching a string or thin stick. Other pieces were rolled into balls, coils or slightly flatenned lumps.
ARC-251	1 - Gopher (1997); 2 - Goren and Goldberg (1991); 3 - Gopher (1989)	Horvat Galil	Residues	The walls and floors of buildings were coated with mud or lime plaster. Floors mostly consisted of crushed carbonatic raw materials (limestone, chalk, etc.) with added clays, ashes and coprolites. Only the top 2-3mm consisted of an impure lime plaster. A red pigment was applied to plaster on both walls and floors.
ARC-252	1 - Goren and Goldberg (1991)	Horvat Galil	Residues	A ball of lime plaster was also recovered.

ARC-253	1 - Gopher (1997); 2 - Goren and Goldberg (1991)	Horvat Galil	Residues	A fragment of a dish was uncovered made from lime plaster mixed with clay and ashes. Another white ware dish was found made from lime plaster mixed with clay and limestone fragments.
ARC-254	1 - Haug Røe (2015)	Hovland 3	Residues	Four flint blades bore possible adhesive traces and may all have been part of a composite tool.
ARC-255	1 - Beneš (2014)	Hrdlovka	Lumps	Sizeable quantities of daub pieces were recovered from buildings, some bearing rectangular imprints from wooden planks.
ARC-256	1 - Guinard and Knutsson (2019)	Huddunge 230	Residues	Twenty-six lithics had drops of a possible adhesive rich in carbon present, which may derive from hafting or been deposited incidentally.
ARC-257	1 - Kjellström *et al.* (2010); 2 - Stern *et al.* (2006)	Huseby Klev	Lumps	Eighteen thin flat lumps with plant fibre impressions or impressions from a large wooden object that had been worked with an axe at only one side were interpreted as boat caulking, some of these had fingerprints on their smooth side from application.
ARC-258	1 - Kashuba *et al.* (2019); 2 - Kjellström *et al.* (2010); 3 - Aveling and Heron (1999)	Huseby Klev	Lumps	Ninety lumps of dull black adhesive were also recovered, with eleven chewed by children between the ages of 5-6 or 16-18 (sometimes repeatedly). This was likely for multiple reasons - adhesive lumps could have been chewed to prepare them for application by increasing pliability, moistening for handling or removing chunks for use. They could also have been chewed for entertainment or hygenic/medicinal reasons, perhaps a combination of multiple factors.
ARC-259	1 - Kjellström *et al.* (2010)	Huseby Klev	Residues	Adhesive was present on a bone point, still bearing the impression of a decayed wooden haft.
ARC-260	1 - Kjellström *et al.* (2010)	Huseby Klev	Lumps	Other lumps have signs of being chewed and then rolled using hands, another had two holes from being pushed onto sticks. Others had

				fragments of birch bark directly adhering to their surfaces, interpreted as having been used to collect material to contaminating it with inclusions of sand/dirt.
ARC-261	1 - Kjellström *et al.* (2010)	Huseby Klev	Lumps	Some had marks from twigs and/or twisted cordage seen as indicating use to waterproof plant-based containers.
ARC-262	1 - Urem-Kotsou *et al.* (2018)	Ilindentsi	Residues	The exterior of three pottery sherds were decorated using plain birch bark tar. The tar was highly degraded from heating at high temperatures. Similar chromatograms for tar samples suggested standardised production methods.
ARC-263	1 - Rees *et al.* (2004)	Inchture	Lumps	Two fragments of burnt daub recovered alongside carbonised cereal grains within a pit, bearing imprints from wattle and soft grass, could have originated from the lining of a storage pit or be the remains of a kiln.
ARC-264	1 - Kuijt (2004)	Iraq ed-Dubb	Residues	The floors of buildings were plastered with mud. A raised platform in the centre of one building was also plastered with mud.
ARC-265	1 - Rampazzi *et al.* (2007)	Ispiluncas	Residues	Samples of paint used to form red and black geometric motifs (horns, spirals, concentric circles, bands) indicated use of haematite and vegetal carbon black pigments in combination with egg glue as a binder.
ARC-266	1 - Zhilin (2018); 2 - Zhilin (2017a); 3 - Zhilin (2017b)	Ivanovskoye 7	Residues	Six composite arrowheads had flint blades fixed in slots with two different hafting adhesives. One was brown and the other was greyish-brown. Experiments indicated they may be conifer resin and a mixture of conifer resin, beeswax and charcoal. The slot of one arrowhead had been filled with adhesive and heated to soften it,

				before flint inserts were inserted. Striations indicate excess adhesive was scraped from its sides after insertion.
ARC-267	1 - Al-Ameri, Jarim and Al-Khafaji (2010); 2 - Braidwood (1954)	Jarmo	Residues	Sickle blades were fixed to wooden hafts with bitumen.
ARC-268	1 - Al-Ameri, Jarim and Al-Khafaji (2010)	Jarmo	Lumps	Lumps of bitumen had impressions suggesting use to strengthen and/or waterproof basketry or trays.
ARC-269	1 - Burgert (2018)	Jaroměř	Residues	Some lithics had traces of adhesive present.
ARC-270	1 - Abbès (2007)	Jerf el-Ahmar	Residues	Flint blades had bitumen residues present.
ARC-271	1 - Kingery, Vandiver and Prickett (1988); 2 - Moore (1978); 3 - Gourdin and Kingery (1975); 4 - Frierman (1971)	Jericho	Lumps; Residues	The floors and walls of buildings were coated with lime plaster. The walls and ground surrounding a tower were coated with mud plaster. Chemical analysis of two loose lumps of adhesive recovered from the site showed they consisted of lime plaster mixed with calcite and quartz.
ARC-272	1 - Cauvin (2003); 2 - Goren, Goring-Morris and Segal (2001); 3 - Goren and Segal (1995); 4 - Kingery, Vandiver and Noy (1992); 5 - Kingery, Vandiver and Prickett (1988); 6 - Moore (1978); 7 - Strouhal (1973)	Jericho	Residues	Human skulls found buried in several caches had their facial features modelled in marl plaster, with eyes rendered using bivalve/cowrie shells or whiter plaster. Chemical and microscopic analysis of two skulls indicated initial application of bitumen to bone surfaces, followed by a preparatory layer of impure marl mixed with sand. Features were then sculpted on a surface layer of purer marl mixed with very small quantities of lime (likely to produce a whiter shade as well as provide greater plasticity/hardness). One skull had haematite incorporated into the clay/lime plaster to avoid damaging features

				from application of powdered haematite. Analysis of another skull identified pure lime plaster. Clay figurines were ornately decorated with orange bands on their legs and black bitumen at the top of their heads and limb joints. The eyes of large plaster statues were rendered with white lime plaster with a black bitumen pupil and traces of a copper-based green pigment at the base of the eye.
ARC-273	1 - Cauvin (2003); 2 - Kingery, Vandiver and Prickett (1988); 3 - Moore (1978)	Jericho	Lumps	Large plaster sculptures representing people were also produced from marl plaster (sometimes mixed with sand) constructed around a core of some loose, crumbly material. Others had their surface layers constructed of lime plaster mixed with sandstone and quartz, with preparatory largely consisting of clay plaster mixed with lime plaster, limestone and quartz. These were assembled around reed cores. One statue had a curly beard applied using pure lime plaster adhesive with the texture of stiff whipped cream.
ARC-274	1 - Robson *et al.* (2021)	Jordløse Mose	Microscopic	Chemical analysis of residues on the interior of a flat open bowl identified traces of ruminant animal fat, dairy products, plant wax or beeswax and pine resin.
ARC-275	1 - Oras *et al.* (2017)	Kääpa	Microscopic	Traces of unidentified resin were identified on 20 sherds.
ARC-276	1 - Philokyprou (2021); 2 - Clarke and Wasse (2019); 3 - Philokyprou (2012)	Kalavasos-Tenta	Residues	The floors, walls and pillars of buildings were plastered yellow, grey or brown with clay/gypsum/lime/mud plaster.
ARC-277	1 - Oras *et al.* (2017)	Kalmaküla	Microscopic	Traces of unidentified resin were identified on 1 sherd.

ARC-278	1 - David (2018)	Kanaljordan	Residues	Two arrowheads and a blade bore traces of birch bark tar adhesive.
ARC-279	1 - Németh (1994)	Kaszás Domb	Residues	A pottery vessel found in a well had resin or bitumen present on its exterior surface.
ARC-280	1 - Rimkus (2018)	Katra I	Microscopic	An arrowhead used in hunting bore tar traces
ARC-281	1 - Pesonen (2013)	Kauniinmetsänniitty 1	Lumps	Nineteen pitch lumps were recovered, with several bearing tooth impressions likely from softening in the mouth to prepare them for use.
ARC-282	1 - Pesonen (2013)	Kauniinmetsänniitty 1	Residues	Radiocarbon dating was conducted on a sample of birch bark tar from a pottery sherd and a lump of chewed pitch.
ARC-283	1 - Goren and Goring-Morris (2008); 2 - Goring-Morris and Horwitz (2007); 3 - Horwitz and Goring-Morris (2004); 4 - Goring-Morris *et al.* (1994-1995); 5 - Goring-Morris (1991)	Kfar HaHoresh	Residues	The floors of buildings, especially those clustered in a central funerary area. Patches of plaster were also placed over graves independently of floors. Joints of aurochs meat totalling 500kg in total were buried in a pit covered over with lime plaster mixed with crushed chalk before a human burial was placed over the top and covered with lime plaster.
ARC-284	1 - Goren and Goring-Morris (2008); 2 - Goring-Morris and Horwitz (2007)	Kfar HaHoresh	Residues	Several concentrations of burnt and heavily cracked cobbles present in pits were tentatively identified as lime production kilns, based on their close similarity with experimental examples. The pores of querns and handstones contained lime plaster residues, likely resulting from involvement in plaster production or application.
ARC-285	1 - Goring-Morris (1991)	Kfar HaHoresh	Lumps	A lump of bitumen was also attested.

ARC-286	1 - Horwitz and Goring-Morris (2004); 2 - Goren, Goring-Morris and Segal (2001); 3 - Hershkovitz *et al.* (1995); 4 - Goring-Morris *et al.* (1994-1995); 5 - Goring-Morris (1991)	Kfar HaHoresh	Residues	Three human skulls bearing plaster faces were recovered. One well-preserved example had been painted light red with ochre. Analysis indicated a thin adhesive layer (resin/bitumen) had been initially poured into the orbital cavity to seal/obstruct ducts and fissures to prevent plaster drainage. A layer of soft plaster high in silica content from added vegetal ash (1:1) was applied to form a granular base onto which a less silica-rich soft plaster was applied. This was to prevent cracking of the surface plaster from moisture absorption by the skull. A layer of rough hard plaster was applied as an outer base onto which a purer surface layer containing much less vegetal ash (5:1 lime) of which features were constructed.
ARC-287	1 - José Ibáñez *et al.* (2020)	Kharaysin	Residues	The floors of buildings were plastered.
ARC-288	1 - Philokyprou (2021); 2 - Philokyprou (2012)	Khirokitia	Residues	The floors, walls and pillars of buildings were plastered yellow or grey with clay or mud plaster.
ARC-289	1 - Mökkönen and Nordqvist (2017)	Kierikin Sorakuoppa	Residues	Birch bark tar residues on a pottery sherd were analysed for 14C dating.
ARC-290	1 - Mökkönen and Nordqvist (2017)	Kierkkisaari	Residues	Birch bark tar residues on the rim of a pottery sherd were analysed for AMS 14C dating.
ARC-291	1 - Berclay *et al.* (2001)	Kinbeachie	Residues	Discolouration present at the base of an axehead may derive from adhesive residue.
ARC-292	1 - Pelisiak (2015)	Kobyłki	Lumps	Two concentrations of daub were interpreted as the remains of two buildings.
ARC-293	1 - Řídký *et al.* (2014)	Kolín	Lumps	Pieces of daub were recovered from two ditches, 205g from the first and 58g from the second.

ARC-294	1 - Burgert (2018)	Kolín	Residues	A blade bore adhesive residues.
ARC-295	1 - Oras *et al.* (2017)	Kõnnu	Microscopic	Traces of unidentified resin were identified on 5 sherds.
ARC-296	1 - Oras *et al.* (2017)	Kõpu	Microscopic	Traces of unidentified resin were identified on 1 sherd.
ARC-297	1 - Erdal (2015)	Körtik Tepe	Residues	Graves were covered over with white gypsum plaster.
ARC-298	1 - Erdal (2015); 2 - Özkaya (2009)	Körtik Tepe	Residues	Six skeletons were coated with a mixture of gypsum and lime plaster (three thinly, three substantially) and pigmented with designs in red and black. Multiple layers of plaster and paint suggested repeated episodes of decoration. Graves were also covered over with white gypsum plaster.
ARC-299	1 - Roffet-Salque *et al.* (2015)	Kouvéléikès A and B	Microscopic	Beeswax present on 2 out of 11 sherds identified as bearing residues (18% of total residues present).
ARC-300	1 - Rumiński and Osipowicz (2014)	Kowal 14	Residues	Residues of lime plaster were present in a ceramic vessel.
ARC-301	1 - Rumiński and Osipowicz (2014)	Kowal 14	Residues	Grey-white adhesive residues present on the arms of an engraved T-shaped ornament found in a grave, made from two pieces of deer antler, were comprised of lime plaster (lime, sand and clay) and possibly animal glue (hide, bone, caesin). These were likely used to strengthen the link between the ornament's pieces.
ARC-302	1 - Sałacińska, Sałaciński and Chojnowska (2018)	Kownacica	Lumps	240 pieces of daub were recovered.

ARC-303	1 - Prokeš *et al.* (2009-2010)	Kralice na Hané	Residues	The lower part of a ceramic vessel had black birch bark tar filling an engraved pit and line. Tar was moderately degraded from heating at medium temperatures.
ARC-304	1 - Rimkus (2018)	Kretuonas 1C	Microscopic	Traces of tar were present on 2 arrowheads with residue traces from soft tissue and bone.
ARC-305	1 - Prokeš *et al.* (2009-2010)	Krhov	Residues	A ceramic sherd had a narrow strip of birch bark tar on its exterior. Tar was moderately degraded from heating at medium temperatures.
ARC-306	1 - Oras *et al.* (2017)	Kroodi	Microscopic	Traces of unidentified resin were identified on 1 sherd.
ARC-307	1 - Roffet-Salque *et al.* (2015)	Künzing-Unternberg	Microscopic	Beeswax present on 1 out of 17 sherds identified as bearing residues (6% of total residues present).
ARC-308	1 - Mökkönen and Nordqvist (2017)	Kuuselankangas	Lumps	Radiocarbon dating was performed on 6 chewed pieces of resin found in two houses.
ARC-309	1 - Di Pascale (2018)	La Capoulière	Lumps	Pieces of daub were recovered from the fill of a ditch bearing wattle impressions, likely originating from the roofs of buildings given the nature of the branches employed.
ARC-310	1 - Terradas *et al.* (2017); 2 - Palomo *et al.* (2011)	La Draga	Residues	A flint sickle blade was fixed into an elder wood haft using Pinus sylvestris resin.
ARC-311	1 - Lucquin, March and Cassen (2007)	La Hougue Bie	Residues	Birch bark tar residues and vegetal fatty acids were present within 2 ceramic footed cups "coupes-à-socles" recovered from a passage grave. These residues could attest use in waterproofing, except for the inability to use the vessels for storage, so it was suggested the strong smell of birch bark tar was intended to mask decomposition or that the cups were used as a portable hearth to heat birch bark tar for other uses.

ARC-312	1 - Regert (2004)	La Karelslé	Residues	Chemical analysis undertaken of 1 sample of adhesive residue present on an arrowhead.
ARC-313	1 - Odriozola *et al.* (2020); 2 - Odriozola Lloret *et al.* (2019)	La Molina	Residues	Two discoidal beads recovered from a burial were coated with pine resin, likely to imitate amber beads from their visual similarity.
ARC-314	1 - Stika (2005)	La Revilla del Campo	Lumps	Six pieces of daub mixed with chaff were recovered.
ARC-315	1 - Perthuison *et al.* (2020)	La Rouvière	Residues	A jar found along with 39 others in a building near a sinkhole used to collect and store water had black residues on its inner surface associated with cracks, indicating use of birch bark tar to repair/waterproof the vessel. Tar was heavily degraded from heating at very high temperatures. Combined with low betulin levels, this suggests the tar remained in a single chamber with bark until the end of the production process.
ARC-316	1 - Stern *et al.* (2006); 2 - Roberts, Barton and Evans (1998)	Lackford Heath	Lumps	A piece of adhesive material was moulded into a lump measuring 3cmx2cmx1cm, although certain indications of moulding could also derive from chewing.
ARC-317	1 - Ballin-Smith (2011)	Laigh Newton	Lumps	Thirteen pieces of daub were recovered, mostly burnt. Many pieces seemed to derive from wattle-and-daub structures but some appeared to have been part of a clay/daub artefact with smoothed surfaces and a slightly rounded edge.
ARC-318	1 - Ballin-Smith (2011)	Laigh Newton	Lumps	Pieces of burnt daub seemed to have originated from a clay/daub artefact, with smoothed surfaces and a slightly rounded edge.
ARC-319	1 - Oliveira *et al.* (2017)	Leira das Mamas	Residues	Anthropomorphic figures painted in white on a stone slab within a tumulus chamber were painted with kaolinite suspended in a binder

				of vegetal oils that were heated using pine materials that left a slight, likely accidental, trace of pine resin within the paint.
ARC-320	1 - Suter, Hafner and Glauser (2005)	Lenk-Schnidejoch	Residues	6 arrows of Wayfaring tree (Viburnum latana) wood found associated with a birch bark quiver had birch bark tar fixing their fletching in place.
ARC-321	1 - Suter, Hafner and Glauser (2005)	Lenk-Schnidejoch	Residues	6 arrows of Wayfaring tree (Viburnum latana) wood found associated with a birch bark quiver had birch bark tar fixing their flint tips in place.
ARC-322	1 - Nandris (1988); 2 - Thuesen and Gwozdz (1982)	Lepenski Vir	Lumps; Residues	The floors of trapezoidal houses were plastered red with lime plaster. Chemical analysis of a sample of floor plaster from a trapezoid house indicated it consisted of lime plaster with quartz inclusions.
ARC-323	1 - Kozlowski, Kaczanowska and Pawlikowski (1996)	Lerna	Residues	Traces of resin are present on the ventral side of blades.
ARC-324	1 - Prokeš *et al.* (2009-2010)	Lešany	Residues	A ceramic vessel had one of its two horned handles repaired with black residues identified as birch bark tar. Tar was moderately degraded from heating at medium temperatures.
ARC-325	1 - Larsson (2007)	Lilla Loshults Mosse	Residues	Flint blades were fixed into two fragmentary wooden arrowshafts with resin. One arrowshaft had two blades remaing, the other had one.
ARC-326	1 - Decavallas (2007)	Limenaria	Microscopic	Pure beeswax residues were present on a perforated pottery sherd. It may have been heated, due to slight degradation.
ARC-327	1 - Soják and Furman (2018)	Liptovské Matiašovce-Bochníčky	Lumps	Pieces of daub ranging from tiny to microscopic in size were recovered.

ARC-328	1 - Oras *et al.* (2017)	Lommi	Microscopic	Traces of unidentified resin were identified on 5 sherds.
ARC-329	1 - Bernardini *et al.* (2012)	Lonche	Residues	A cavity on an adult human canine tooth was filled with beeswax, either after death or more probably during life as a dental filling to relieve pain.
ARC-330	1 - Roffet-Salque *et al.* (2015)	Lonche	Microscopic	One pottery sherd also bore beeswax residues.
ARC-331	1 - Salque *et al.* (2013)	Ludwinowo 7	Microscopic	Traces of pure beeswax were detected in a cooking pot and 4 flasks. Mixtures of beeswax with dairy were detected on 4 ceramic sieves.
ARC-332	1 - Stojanovski *et al.* (2020)	Magarevi Mlin	Microscopic	Beeswax residues were identified on two pottery sherds and may have been present on another sherd which could not be unambigously identified. It was mixed with dairy products on one of the sherds and the further possible sherd, pure beeswax residues were present on the other.
ARC-333	1 - Mirea (2011)	Mägura-Buduiasca	Lumps	Pieces of burnt and unburnt daub were recovered from a pit, likely indicating the presence of a shelter or house over the pit.
ARC-334	1 - Efstratiou (2010); 2 - Karkanas and Efstratiou (2009); 3 - Karkanas (2007)	Makri	Residues	The floors of buildings were coated with lime plaster about 2-3mm thick. This consisted of quicklime mixed with unburnt tufa (limestone) with occasional additions of ordinary sediment and domestic refuse (ash, dung, food remains) via a "hot mixing" technique. A number of coats were applied consisting of finer layers of plaster seperated by 2-3 less well-prepared floors, capped by a finishing layer which was kept scrupiously clean and often coated with red clay. Impressions of articulated phytoliths are sometimes preserved, which may represent decayed organic matting. Seasonal

				replastering of floors was not observed at the site like in the Near East - floors were instead reconstructed once worn down by adding quicklime mixed with debris via a "hot mixing" technique over the old floor and applying a new floor layer over that. A number of vessels were also built from plaster.
ARC-335	1 - Urem-Kotsou *et al.* (2018); 2 - Mitkidou *et al.* (2008); 3 - Stern *et al.* (2006); 4 - Urem-Kotsou *et al.* (2002)	Makriyalos 1	Residues	Six pottery sherds bore traces of beeswax on their interior surfaces, potentially deriving from waterproofing, storage of beeswax or use as a preservative or disinfectant for vessel contents.
ARC-336	1 - Urem-Kotsou *et al.* (2018); 2 - Mitkidou *et al.* (2008); 3 - Urem-Kotsou *et al.* (2002); 4 - Stern *et al.* (2006)	Makriyalos 1	Residues	One study analysed eight pottery sherds with repair adhesives finding 2 consisted of pure birch bark tar, 1 of birch bark tar with animal fat, 2 of birch bark tar with pine resin and one of pine bark tar. Another study identified 7 possible repair adhesives as consisting of 5 pure birch bark tar and one pine bark tar. A third study identified use of pure birch bark tar to repair a carinated bowl and a fourth use of birch bark tar in repairing two sherds. Considerable variation in tar degradation and diverse chromatograms indicated less standardised adhesive production or reusage of tar. Pine resin had minimal alteration suggesting it was merely warmed for use rather than heated for a prolonged period.
ARC-337	1 - Urem-Kotsou *et al.* (2018); 2 - Mitkidou *et al.* (2008); 3 - Urem-Kotsou *et al.* (2002); 4 - Stern *et al.* (2006)	Makriyalos 1	Residues	Two pottery sherds bore indeterminate tar residues identified as birch bark tar and a mixture of birch bark tar and animal fat. Another study identified use of birch bark tar (2) and pine resin (1) on three sherds. Considerable variation in tar degradation and diverse chromatograms indicated less standardised adhesive production or

				reusage of tar. Pine resin had minimal alteration suggesting it was merely warmed for use rather than heated for a prolonged period.
ARC-338	1 - Urem-Kotsou *et al.* (2018); 2 - Mitkidou *et al.* (2008); 3 - Urem-Kotsou *et al.* (2002); 4 - Stern *et al.* (2006)	Makriyalos 1	Residues	One study analysed thirteen pottery sherds with adhesive traces indicative of waterproofing, finding 1 consisted of birch bark tar, 2 birch bark tar and animal fat, 1 pine bark tar and 3 pine resin. Another study examined 5 sherds, finding use of birch bark tar to waterproof two and pine resin on three. A third study found traces of plain birch bark tar on two sherds and a fourth found traces of birch bark tar on 4 sherds. Considerable variation in tar degradation and diverse chromatograms indicated less standardised adhesive production or reusage of tar. Pine resin had minimal alteration suggesting it was merely warmed for use rather than heated for a prolonged period.
ARC-339	1 - Budja *et al.* (2013)	Mala Triglavca	Residues	Wax esters (deriving from either plants or beeswax) in combination with animal fats were detected in three vessels, likely from mixing of honey with other commodities. 30% of 36 other pottery sherds analysed contained dairy residues.
ARC-340	1 - Robson *et al.* (2021)	Målevgård Mose	Microscopic	Chemical analysis of residues on the interior of two funnel bowls identified traces of ruminant animal fat, dairy products, plant sugars, pine resin and aquatic products. The resin likely derived from its storage or processing within the bowl.
ARC-341	1 - Mirković-Marić and Marić (2017)	Mali Alas	Lumps	Pieces of burnt daub were recovered associated with pottery within a trench.
ARC-342	1 - Rampazzi *et al.* (2007)	Mandra Antine	Residues	Geometric motifs (horns, spirals, concentric circles and bands) were painted in red and black using haematite and vegetal carbon black in

				an egg glue binder. The result was somewhere between egg glue and collagen glues, but this was attributed to bacterial contamination.
ARC-343	1 - McClure *et al.* (2006)	Mas d'Is	Lumps	Three pieces of daub were analysed.
ARC-344	1 - Mirković-Marić and Marić (2017)	Matesjski Brod	Lumps	The walls of seven buildings were plastered with daub.
ARC-345	1 - Keller (1866)	Meilen-Rorenhaab	Residues	A flint flake was fixed into a yew wood haft with pitch or bitumen.
ARC-346	1 - Stern *et al.* (2006)	Melkoya	Residues	Two arrowheads recovered from within buildings were hafted with birch tar.
ARC-347	1 - Stern *et al.* (2006)	Melkoya	Lumps	Two lumps of birch tar were recovered from within buildings.
ARC-348	1 - Lyonnet *et al.* (2016)	Mentesh Tepe	Residues	A few pottery sherds from the site were painted black with probable bitumen.
ARC-349	1 - Garrard and Yazbeck (2013)	Moghr el-Ahwal	Residues	A stone bin measuring 80cm wide was fixed into the floor using lime plaster, in several layers due to replasterings.
ARC-350	1 - Lisch (1872); 2 - von Maltzan, Ritter and Lisch (1845); 3 - Lisch (1841)	Moltzow	Residues	Incised lines decorating three other urns were filled with lime plaster.
ARC-351	1 - Lisch (1872); 2 - von Maltzan, Ritter and Lisch (1845); 3 - Lisch (1841)	Moltzow	Residues	A large urn found in a grave was repaired with a sherd from another vessel cemented in place with brown adhesive, similar to previous finds of resin cakes from Bronze Age sites.
ARC-352	1 - Fontana *et al.* (2020); 2 - Cattani (1993)	Mondeval de Sora	Lumps	Two concentrations of material found buried near the left hand of an an adult male suffering from Rosy-Cajal disease were interpreted as the contents of bags made from organic material. The first consisted

				of two chert lithics and a lump of adhesive principally composed of conifer resin with small quantities of propolis resin (produced by bees). The second consisted of a boar tusk, nine lithics and a lump of adhesive consisting almost entirely of propolis resin. The first lump was interpreted as a glue, while the second was interpreted as medicinal in nature.
ARC-353	1 - Fontana *et al*. (2020); 2 - Cattani (1993)	Mondeval de Sora	Lumps	Two concentrations of material found buried near the left hand of an an adult male suffering from Rosy-Cajal disease were interpreted as the contents of bags made from organic material. The first consisted of two chert lithics and a lump of adhesive principally composed of conifer resin with small quantities of propolis resin (produced by bees). The second consisted of a boar tusk, nine lithics and a lump of adhesive consisting almost entirely of propolis resin. The first lump was interpreted as a glue, while the second was interpreted as medicinal in nature.
ARC-354	1 - Hayek *et al*. (1990)	Mondsee	Residues	Two arrowheads bore traces of birch tar.
ARC-355	1 - Keller (1866)	Moosseedorf	Residues	A flint "saw" was set into a fir wood handle with bitumen and a bone awl had a handle manufactured of bitumen.
ARC-356	1 - Keller (1866)	Moosseedorf	Residues	Two fragments of a pottery vessel were repaired with cord, with a mixture of bitumen and ashes fixing it within holes drilled either side of the fracture.
ARC-357	1 - Madsen and Jensen (1982)	Mosegarden	Lumps	Pieces of burnt daub likely deriving from buildings were recovered.

ARC-358	1 - Khalaily and Vardi (2020); 2 - Yerkes, Khalaily and Barkai (2012); 3 - Khalaily, Marder and Barzilai (2007); 4 - Khalaily *et al.* (2007)	Motza	Residues	The floors and lower parts of walls of buildings were plastered with lime. Floor construction techniques varied, with some thick layers and others thin in nature. Some had a foundation layer of stones mixed with plaster fragments, followed by an initial preparatory layer of poorer quality lime plaster mixed with various inclusions such as charcoal, then finished with a layer of fine lime plaster burnished and painted red. Others were directly applied onto burnt clay layers. Fragments of clay plaster and twigs were interpreted as deriving from ceilings. Grain silos were also plastered. Graves under building floors were associated with fine lime plaster – as either patches at their base or thin layers surrounding/encasing/covering skeletons.
ARC-359	1 - Khalaily and Vardi (2020)	Motza	Residues	Grain silos were also plastered.
ARC-360	1 - Šoberl *et al.* (2014)	Moverna Vas	Residues	Chemical analysis demonstrated sixteen pottery sherds deriving from seven vessels bore black birch bark residues on their interior or exterior surfaces, with three vessels having the tar mixed with beeswax. It only occurred on pedestal dishes or pots. It was suggested from a previous paper focusing on adhesive residues in pedestal dishes that the tar was used as incense, perhaps in funerary rites to cover up the smell of decomposition.
ARC-361	1 - Šoberl *et al.* (2014)	Moverna Vas	Residues	Analysis also identified various animal and plant products processed or stored in various pottery vessels, often mixed together in the same vessels, with 27% having wax esters deriving from either plants or beeswax. While in most cases this was suggested to result from the processing of honey for food, pure beeswax was found alone in one

				cup with no animal or plant products present. However, beeswax was likely not used to waterproof or seal containers, as experiments indicated its propensity to flake off, damaging the pot fabric in the process, suggesting processing.
ARC-362	1 - Vardi and Mizrahi (2019)	Moẓa	Residues	One sickle blade bore adhesive traces.
ARC-363	1 - Beech *et al.* (2020); 2 - Beech *et al.* (2005)	MR11	Lumps	Fragments of plaster vessels were recovered.
ARC-364	1 - Diachenko *et al.* (2021)	Mrowino 3	Lumps	A significant quantity (222,920kg or 10,716 pieces) of burnt daub were recovered from buildings, pits and trenches at the site.
ARC-365	1 - Moore (1978)	Munhatta	Residues	The floors and walls of buildings were plastered. Hearths and mudbrick benches were plastered as well.
ARC-366	1 - Sánchez Priego and Brenet (2007); 2 - Anderson (1991); 3 - Coqueugniot (1983)	Mureybet	Microscopic; Residues	Nineteen tools bore black adhesive residues on their backed edges or bases, possibly bitumen.
ARC-367	1 - Jordanova *et al.* (2018)	Mursalevo-Deveboaz	Lumps	Large quantities of burnt daub representing building walls and floors were recovered from 25 different buildings. 445 burnt daub samples were subjected to mineral magnetic analysis to assess fire temperatures (very high, in excess of 1000°C).
ARC-368	1 - Grosman, Raz and Friesem (2020); 2 - Friesem *et al.* (2019); 3 - Grosman *et al.* (2016)	Nahal Ein Gev II	Residues	A round pit had been plastered three times - either representing a single or multiple episodes of plastering. Chemical and microscopic analysis indicated differential use of mud and lime plaster, sometimes in combination. The use of the pit was uncertain. Eight graves consisting of pits cut into the natural bedrock were lined with a 40cm thick layer of white lime plaster. Local sediment was then used to

				cover the bodies and a layer of small stones added above the grave. Chemical analysis indicated the lime had likely been mixed with water and local sediment to form a plaster while still hot, due to the uneven nature of reactions with some areas well carbonated and others only partly and some level of burning on skeletal material, leaving unburnt clay inclusions. Lime plaster had been mixed with water and sediment while still hot, likely within the actual graves due to burning of skeletal material.
ARC-369	1 - Bar-Yosef and Belfer-Cohen (2000)	Nahal Ein Gev II	Residues	A fragmentary sickle blade also had some unidentified adhesive material stuck to its edge.
ARC-370	1 - Borrell, Ibáñez and Bar-Yosef (2020); 2 - Bar-Yosef (1987)	Nahal Hemar	Residues	45 lithics bear partially carbonised black adhesive residues, likely also collagen glue, in the form of irregular and fluid-like stains. One complete sickle consists of three blades inserted into grooves with black adhesive into a curved horn haft, which had one of its side decorated with a triple incised zigzag motif. Black adhesives were initially interpreted as bitumen but chemical analyses have consistently identified residues on lithics and skulls as collagenaceous in nature. The use of collagen was intriguing given the presence of a bitumen source in the immediate site vicinity - either the materials present were imported from elsewhere or sediments covered the bitumen source at the time of occupation.
ARC-371	1 - Solazzo *et al.* (2016); 2 - Cauvin (2003); 3 - Kingery, Vandiver and Prickett (1988); 4 -	Nahal Hemar	Lumps	Lumps of adhesive with reed impressions and fragments of preserved plant-based containers with adhesive residues adhering indicated use to line or waterproof basketry - with analysis of such residues indicating one to be purely bovine collagen glue mixed with bovine

	Connan, Nissenbaum and Dessort (1995); 5 - Schick (1986)			blood and another also including proteins from Drimia maritima (sea onion) which was interpreted as either deliberately added or contamination from storage or transport of this material in basketry. The substance would have had medicinal or insecticidal properties. A loose flake of adhesive material was also identified as bovine collagen glue mixed with bovine blood. Analysis of the bovine collagen glue indicated it to be closer to bone collagen, but it could also result from skin collagen. Black adhesives were initially interpreted as bitumen but chemical analyses have consistently identified residues on lithics and skulls as collagenaceous in nature. The use of collagen was intriguing given the presence of a bitumen source in the immediate site vicinity - either the materials present were imported from elsewhere or sediments covered the bitumen source at the time of occupation. A number of basketry fragments were also waterproofed using very pure lime plaster mixed with calcite aggregate.
ARC-372	1 - Borrell, Ibáñez and Bar-Yosef (2020); 2 - Solazzo *et al.* (2016); 3 - Cauvin (2003); 4 - Connan, Nissenbaum and Dessort (1995); 5 - Bar-Yosef and Alon (1988); 6 - Yakar and Hershkovitz (1988)	Nahal Hemar	Residues	Black organic coating was present on six human skulls as thin brown-black layers with additional adhesive applied in a net pattern evoking a headdress. Chemical analysis of two samples of this adhesive from one skull identified it as a mixture of bovine collagen glue and styrax officinalis (Styrax) resin. The styrax may have been included for ritual reasons and/or to perfume the skull. Small figurines of human heads crudely crafted from clay and bone were finely painted in black adhesive plus green, red and white and a stone mask together with a mouth fragment from another mask was painted with designs in red and green with some traces of black adhesive that may have fixed on

				hair. Black adhesives were initially interpreted as bitumen but chemical analyses have consistently identified residues on lithics and skulls as collagenaceous in nature. The use of collagen was intriguing given the presence of a bitumen source in the immediate site vicinity - either the materials present were imported from elsewhere or sediments covered the bitumen source at the time of occupation.
ARC-373	1 - Cauvin (2003)	Nahal Hemar	Residues	Two stone masks bore traces of black adhesive at their tops that may have fixed on hair.
ARC-374	1 - Cauvin (2003); 2 - Goren, Segal and Bar-Yosef (1993); 3 - Kingery, Vandiver and Prickett (1988)	Nahal Hemar	Lumps	Several anthropomorphic statue fragments were formed out of relatively impure lime plaster (containing some limestone and clay as well), one of these contained a high aggregate temper of 60% quartz. Others contained sparser 2% quartz aggregate, with one consisting of chalk instead and another containing no mineral aggregate. All save one contained some proportion of vegetal fibres, in one case maybe from linen. These statues were painted with red ochre, green copper silicate and black adhesive. Beads were produced from lime plaster with added calcite providing a glittering appearance formed around a cord core.
ARC-375	1 - Gopher *et al.* (2019)	Nahal Yarmuth 38	Residues	The floors of buildings were plastered. Bodies were buried in pits under plastered floors.
ARC-376	1 - Kabaciński *et al.* (2015)	Nakonowo Stare 2	Residues	Ceramic sherds found within a cist grave displayed tar residues used for repairing broken vessels, which contained a mineral component for added strength. Tar was slightly degraded from heating at lower temperatures. A lack of any microporous structures suggested it was produced via a two-chamber method to yield a purer tar.

ARC-377	1 - Oras *et al.* (2017)	Narva Joaorg	Microscopic	Traces of unidentified resin were identified on 13 sherds.
ARC-378	1 - Burdo and Videiko (2015)	Nebelivka	Lumps	Rectangular deposits of burnt daub fragments, some bearing imprints from wood and ropes, were seen as indicative of buildings. These varied widely in size and thickness.
ARC-379	1 - Cherry *et al.* (1988)	Nemea 702	Lumps	Pieces of unburnt daub were recovered from buildings.
ARC-380	1 - Kozłowski (2008); 2 - Kozłowski and Kempisty (1990); 3 - Kozłowski (1989)	Nemrik 9	Residues	The walls, floors and platforms of houses during the middle and later phases of occupation were plastered with clay. There was some limited evidence for lime plaster used to coat pillars used to hold up the roofs of type-D houses alongside clay plasters, with some bearing impressions from the wickerwork scaffolding used in their construction. Some faint traces of black, red and yellow paints were preserved on plaster floors and walls. Charred lumps of clay from roofs indicated they were a lattice of poles/branches probably covered by straw and plastered with clay on both sides.
ARC-381	1 - Jones *et al.* (2019)	Ness of Brodgar	Residues	23 ceramic sherds were painted with white paint, some also with black or red. White derived from bovine bone ash, red from haematite and black from charcoal. The more fugitive nature of red pigment seems to suggest the use of a resin as a binder, rather than direct application by adhesion.
ARC-382	1 - Lübke, Lüth and Terberger (2009)	Neuenfeld 17	Residues	Dark adhesive residue present on 2 flint tools included in a grave.
ARC-383	1 - Sweetman *et al.* (1985)	Newgrange	Residues	The surface of pits had been plastered with clay and subjected to considerable burning.

ARC-384	1 - Roffet-Salque *et al.* (2015)	Niederhummel	Microscopic	Beeswax present on 1 out of 2 sherds identified as bearing residues (50% of total residues present).
ARC-385	1 - McClure *et al.* (2006)	Niuet	Lumps	Three pieces of daub were analysed.
ARC-386	1 - Keller (1866)	Nußdorf	Residues	Three stone celts were fixed into antler hafts with asphalt. Another 8 were similarly fixed into yew wood handles.
ARC-387	1 - Ivanovaitė *et al.* (2018)	Obšrūtai	Residues	Adhesive residues present on a slotted bone point with flint microliths.
ARC-388	1 - de Senna-Martinez (2018)	Orca da Lapa do Lobo	Lumps	Pieces of burnt daub represented the remains of collapsed buildings indicated by postholes.
ARC-389	1 - Grigorescu (2020)	Ordea-Salca	Lumps; Residues	Pits were coated with yellow clay and daub. Pieces of daub were also present within the pits.
ARC-390	1 - Robson *et al.* (2021)	Orehøj Mose	Microscopic	Chemical analysis of residues on the interior of a collared flask identified traces of pine resin and plant wax or beeswax.
ARC-391	1 - Hoebe (2014); 2 - Lübke, Lüth and Terberger (2009)	Ostorf-Tannenwerder I	Residues	Resin present on a number of arrowheads found in graves.
ARC-392	1 - Chmielewski *et al.* (2017)	Otice-Rybníčky	Lumps	Pieces of daub containing chaff/straw from buildings were recovered from pits and subjected to C14 and archaeobotanical analysis.
ARC-393	1 - Papakosta and Pesonen (2019)	Oulu Vepsänkangas	Microscopic	A number of pieces of chewed resin were also recovered.
ARC-394	1 - Papakosta and Pesonen (2019)	Oulu Vepsänkangas	Microscopic	1 ceramic sherd had traces of resin or tar deriving from a conifer species. Another 3 sherds had traces of animal fat likely deriving from elk or reindeer.
ARC-395	1 - Stern *et al.* (2006); 2 - Aveling and Heron (1999)	Øvre Storvatnet	Lumps	A small piece of black adhesive with teeth impressions derving from a child aged 6-7 was recovered.

ARC-396	1 - Rimkus (2018)	Pakretuonė 4	Microscopic	Tar residue was present on 1 arrowhead bearing traces of soft animal tissue and bone.
ARC-397	1 - Urem-Kotsou *et al.* (2018); 2 - Mitkidou *et al.* (2008)	Paliambela	Residues	Three ceramic sherds bore traces of pure birch bark tar used in repairing. The tar had varied degrees of degradation, showing different samples were heated at high or low temperatures. Similar chromatograms for tar samples suggested standardised production.
ARC-398	1 - Roffet-Salque *et al.* (2015)	Paliambela	Microscopic	Another study found beeswax was present on 1 out of 27 sherds identified as bearing residues (4% of total residues present).
ARC-399	1 - Micheli *et al.* (2018)	Palù di Livenza	Residues	Analysis of another sample taken from a large amorphous piece of tar consisting of many layers demonstrated it was the remains of a birch bark roll heated to extract tar.
ARC-400	1 - Micheli *et al.* (2018)	Palù di Livenza	Lumps	Samples were taken from three small pieces of birch bark tar that bore teeth marks from chewing.
ARC-401	1 - Bleicher *et al.* (2015)	Parkhaus Opéra	Residues	A yew wood bow was backed with bark strips (possibly cherry bark) using hide glue produced from a domestic ovicaprid or cattle. Detected haemoglobin may be an accidental inclusion from hide extraction or gelatinisation or a deliberate inclusion.
ARC-402	1 - Chesnaux (2009)	Pas de la Charmate	Residues	Small faint spots of black residue on microliths may represent a hafting adhesive.
ARC-403	1 - Urem-Kotsou *et al.* (2018)	Pavlovac-Gumnište	Residues	2 samples taken from repair adhesives applied to ceramic sherds were identified as pure birch bark tar. Tar was heavily degraded from heating at high temperatures.
ARC-404	1 - Oudemans *et al.* (2019)	Pestenacker	Residues	Four ceramic vessels bore traces of birch bark tar, in one instance mixed with lipids. The three with plain birch tar had been used for

				repair, while the compound tars use was uncertain and could perhaps have been used for other purposes.
ARC-405	1 - Oudemans *et al*. (2019)	Pestenacker	Residues	Four ceramic vessels bore traces of birch bark tar, in one instance mixed with lipids. The three with plain birch tar had been used for repair, while the compound tars use was uncertain and could perhaps have been used for other purposes.
ARC-406	1 - Leuzinger (2005)	Pfyn-Breitenloo	Residues	A flint blade was fixed in an apple wood handle on its backed portions with birch bark tar. The tar bore six negative impressions of cereal grains.
ARC-407	1 - Ammerman, Shaffer and Hartmann (1988)	Piana di Curinga	Lumps	Over 1000kg of burnt daub was recovered from the remains of a building bearing impressions from timber and branches.
ARC-408	1 - Amkreutz and Spithoven (2019)	Pijnacker	Residues	A antler/bone point with possible adhesive on its backed portions, either pitch or tar. It had been brought to the site in dredging sand from Euroguel in the North Sea.
ARC-409	1 - Reitmaier (2012)	Plan da Mattun	Residues	A flint arrowhead had birch bark tar adhesive adhering to its base.
ARC-410	1 - Larsson (1996)	Poças de São Bento	Lumps	Pieces of burnt clay daub were found with impressions of branches suggesting architectural use on buildings.
ARC-411	1 - Larsson (1996)	Poças de São Bento	Lumps	Pieces of burnt clay daub were found beside pits and postholes.
ARC-412	1 - Hardy (1999)	Pod Křídlem	Microscopic	Various tools had black adhesive residues present.
ARC-413	1 - Hardy and Svoboda (2009); 2 - Hardy (1999)	Pod Zubem	Microscopic; Residues	Black adhesive residues were present on 23 blades/bladelets and 8 flakes. One study identified these as conifer resin but another suggested only that they possibly derived from a softwood.

ARC-414	1 - Szeliga, Przeździecki and Grabarek (2019)	Podlesie	Residues	Wood tar, likely birch bark tar, was present on two ceramic sherds.
ARC-415	1 - Bosquet *et al.* (2001)	Podrî l'Cortri	Residues	Dark adhesive residues were also present on a few lithics.
ARC-416	1 - Regert (2004); 2 - Bosquet *et al.* (2001)	Podrî l'Cortri	Residues	Pure birch bark tar was used to repair four pottery vessels. In two instances, residues were present in/around holes drilled near breaks through which cord was passed and on another two vessels fragmented into several pieces, break surfaces were directly sealed with tar. The level of damage to these last two suggests aesthetic consideration behind the repairs, as the structural integrity of the vessel would have remained compromised regardless, limiting its utilitarian purposes. Tar residues appeared in two different colours – shiny black streaks and matte brown residues possibly containing an aggregate. The tar was highly degraded from heating at high temperatures. Similar chromatograms for tar samples suggested standardised production methods and possibly individuals specialised in adhesive production.
ARC-417	1 - Bosquet *et al.* (2001)	Podrî l'Cortri	Residues	Streaks of shiny black pure birch tar were present on the exterior of vessels, of uncertain purpose.
ARC-418	1 - Teoh, McClure and Podrug (2014)	Pokrovnik	Lumps	Samples of daub were analysed from the site.
ARC-419	1 - Chapman (2002)	Polgar-10	Lumps	Concentrations of daub pieces indicated the presence of buildings.
ARC-420	1 - Moskal-del Hoyo and Lityńska-Zając (2016)	Polgár-Bosnyákdomb	Lumps	Pieces of burnt daub found in a ditch surrounding the site were recovered.

ARC-421	1 - Raczky *et al.* (2015); 2 - Sebök *et al.* (2013)	Polgár-Csőszhalom	Residues	29 fragments of ceramic were painted black with probable birch tar.
ARC-422	1 - Kufel-Diakowska *et al.* (2019)	Polwica-Skrzypnik	Residues	Black adhesive from birch bark tar was present on two lithics.
ARC-423	1 - Roffet-Salque *et al.* (2015)	Profitis Ilias Rizoupolis	Microscopic	Beeswax present on 5 out of 20 sherds identified as bearing lipid residues (25% of total residues present).
ARC-424	1 - Urem-Kotsou *et al.* (2018)	Promahonas	Residues	Birch bark tar mixed with animal fat was used to decorate 3 ceramic sherds. Similar chromatograms for birch bark tar samples indicated standardised tar production.
ARC-425	1 - Pelisiak (2015)	Ptaszkowice	Lumps	Five concentrations of daub were interpreted as the remains of five buildings.
ARC-426	1 - Vahur, Kriiska and Leito (2011)	Pulli	Residues	Black adhesive present on a flint blade was identified as birch bark tar mixed with animal fat and possibly fir resin. Dark adhesives were also present on a number of slotted points. Lumps of adhesive material were also attested, one of which was chemically similar to the mixture used to haft the flint blade.
ARC-427	1 - Vahur, Kriiska and Leito (2011)	Pulli	Lumps	Lumps of adhesive material were also attested, one of which was chemically similar to the mixture used to haft a flint blade.
ARC-428	1 - Gopher *et al.* (2013)	Qumran Cave 24	Residues	2 flint sickle blades bore black adhesive containing white grits at their bases.
ARC-429	1 - Van Gijn and Schallig (1997)	R39	Residues	12 scrapers and one slate point bore traces of probable resin. A further 2 flakes and 1 blade bore traces of possible resin.
ARC-430	1 - Viberg, Berntsson and Lidén (2013)	RAÄ 1372	Lumps	Small pieces of resin recovered, one of which had the imprint of a human tooth suggesting it was chewed to give it the desired shape, likely for hafting.

ARC-431	1 - Pesonen (1999)	Rääkkylä Pörrinmökki	Residues	Birch bark tar was present as a strip covering a break on a ceramic sherd. The tar was degraded from heating at high temperatures.
ARC-432	1 - Pesonen (1996)	Rääkkylä Pörrinmökki	Lumps	A lump of resin bearing tooth marks was also recovered.
ARC-433	1 - Bondetti *et al.* (2021)	Rakushechny Yar	Microscopic	One pottery vessel similar in appearance to oil lamps bore traces of conifer resin.
ARC-434	1 - Lanting and Van der Plicht (1995); 2 - Hedges (1990)	Rekem	Residues	Radiocarbon dating was performed on resin adhering to a flint arrowhead.
ARC-435	1 - Stöckl and Westermann (2004)	Rheinhausen	Residues	The interior of a ceramic bowl with incised decorations had a layer of black adhesive residue in its base and around the upper rim, particularly in an around two large holes opposite each other. Cursory analysis suggested this to be birch bark tar and may result from either the attachment of handles/spouts to the holes or the processing and pouring of pitch from within the bowl, which would better explain the black layer at the base.
ARC-436	1 - Oras *et al.* (2017)	Riigiküla IV	Microscopic	Traces of unidentified resin were identified on 3 sherds.
ARC-437	1 - Stern *et al.* (2006)	Ringsjöholm	Lumps	A lump of birch tar bearing possible teeth impressions was recovered.
ARC-438	1 - Cristiani, Pedrotti and Gialanella (2009)	Riparo Gaban	Microscopic; Residues	27 different lithics originating from both the Mesolithic and Neolithic levels of the site bore brown adhesive residues on their backed edges identified as a mixture of bitumen and beeswax. Seven of these tools plus another ten lacking adhesive residues bore red residues identified as a mixture of haematite, calcite and an unidentified alumino-silicate, suggested to originate from tool bindings dyed red.

				Red residues likely deriving from tool bindings are attested from contemporary suspended ornaments from the region. Substantial continuity was attested in adhesives employed by Mesolithic and Neolithic populations.
ARC-439	1 - Cristiani, Pedrotti and Gialanella (2009)	Riparo Gaban	Microscopic; Residues	27 different lithics originating from both the Mesolithic and Neolithic levels of the site bore brown adhesive residues on their backed edges identified as a mixture of bitumen and beeswax. Seven of these tools plus another ten lacking adhesive residues bore red residues identified as a mixture of haematite, calcite and an unidentified alumino-silicate, suggested to originate from tool bindings dyed red. Red residues likely deriving from tool bindings are attested from contemporary suspended ornaments from the region. Substantial continuity was attested in adhesives employed by Mesolithic and Neolithic populations.
ARC-440	1 - Nardella *et al.* (2019)	Ripatetta	Residues	Geochemical analysis of bitumen residues on two flint flakes demonstrated they did not originate from sources in Abruzzo.
ARC-441	1 - Riley (1957)	Risby Warren	Lumps	Pieces of burnt clay daub containing grasses and bracken fonds were found scattered over the site and as infill in pits.
ARC-442	1 - Amkreutz and Spithoven (2019)	Rockanje	Residues	Adhesive residues present on the backed portions of 2 bone or antler points found in dredging sand brought to the site from Bollen van Goeree (Doggerland).
ARC-443	1 - Larsson, Sjöström and Heron (2016); 2 - Larsson and Sjöström (2011); 3 - Larsson and Sjöström (2010)	Rönneholms Mosse	Residues	Four flint microliths were fixed into the side of a hazel wood arrowshaft by their backed edges using birch bark tar. A loose microlith was interpreted as the tip of the arrow despite lacking adhesive residues. However, another microlith that fit neatly into a

				tar-covered groove also lacked visible adhesive residues. Birch bark tar was applied in long strings and remained uneven and waxy as if not smoothed out or moulded after application. Once the microliths were inserted, more tar was applied along their edges.
ARC-444	1 - Rageot *et al.* (2021)	Rosheim	Residues	One lithic was hafted with birch tar.
ARC-445	1 - Casanova *et al.* (2020)	Rosheim	Microscopic	14 out of 189 ceramic sherds analysed bore traces of beeswax. Of these, 5/103 originated from LBK levels, 5/57 from Grossgartach levels and 4/29 from Rössen levels. 9 out of 189 bore dairy residues - 0/103 from LBK levels, 2/57 from Grossgartach levels and 7/29 from Rössen levels. 71 out of 189 bore animal fats - 36/103 from LBK levels, 25/57 from Grossgartach levels and 10/29 from Rössen levels.
ARC-446	1 - Saile, Sedlmaier and Dębiec (2018)	Rovantsi	Residues	Triangles of brown pitch covered up incised decoration on ceramic sherds, with the pitch only surviving within these older incised areas.
ARC-447	1 - Kabaciński *et al.* (2015)	Rożniaty 2	Residues	Tar was used to coat the inner surface of ceramic vessels.
ARC-448	1 - Kabaciński *et al.* (2015)	Rudna Wielka 5	Residues	Black tar residues were observed on several ceramic sherds. Chemical analysis of 5 samples of tar - 1 from an internal surface, 4 from external surfaces demonstrated it to be birch bark tar. 2 samples from painted designs on the exterior of ceramic vessels had a mineral element to them indicating admixture.
ARC-449	1 - Kabaciński *et al.* (2015)	Rudna Wielka 5	Residues	Black tar residues were observed on several ceramic sherds. 3 tar samples derived from production remains on the surfaces of vessels. The lack of contamination from birch bark in the production residues suggests the use of a two-chamber production method. One of these

				production samples had heavy thermal degradation from heating, while the other two had less intense degradation.
ARC-450	1 - Oras *et al.* (2017)	Ruhnu II	Microscopic	Traces of unidentified resin were identified on 1 sherd.
ARC-451	1 - Needham and Evans (1987)	Runnymede Bridge	Microscopic	A sherd bore traces of beeswax, resin and glucose and another bore traces of resin. The combination of beeswax and glucose suggests use of honey as a food flavouring rather than a sealing agent, especially as this adhesive was not in the body of the vessel. Other ceramic sherds bore traces of fatty acids indicative of cooking fish and pork.
ARC-452	1 - Roffet-Salque *et al.* (2015); 2 - Copley *et al.* (2005)	Runnymede Bridge	Microscopic	Another study identified beeswax on two ceramic sherds identified as bearing residues (3% of total residues present). A further study identified possible beeswax residues, heavily degraded, on one sherd.
ARC-453	1 - Kabaciński *et al.* (2015)	Ryńsk 42	Residues	Black tar was used to paint ceramic vessels. Pre-existing geometric engravings were filled with a 1mm layer of matt black tar, while external surfaces were initially covered with a layer of red ochre, evening the surface and aiding adhesion, onto which tar was applied. Microscopic analysis showed the presence of a large quantity of sand aggregate was added intentionally due to its even distribution throughout the mixture, to improve the adhesion and durability of the paint layer
ARC-454	1 - Pesonen *et al.* (2012)	Saarijärvi Summassaari Uimaranta	Residues	2 sherds of pottery had birch tar residues radiocarbon dated.
ARC-455	1 - Goring-Morris *et al.* (1999)	Saflulim	Residues	A few lithics from the site had lime plaster adhering to their backed lateral edges.

ARC-456	1 - Goring-Morris *et al.* (1999)	Saflulim	Lumps	A lump of resin possibly mixed with ash was found - this remains unidentified, but was not bitumen.
ARC-457	1 - Bar-Yosef *et al.* (1991); 2 - Bar-Yosef (1980)	Salibiya IX	Residues	Sickle blades had bitumen adhering to their backed edges.
ARC-458	1 - Quero, Martinelli and Giordano (2019)	San Martino	Lumps	A sizeable quantity of burnt daub fragments were recovered from buildings.
ARC-459	1 - Bernardini *et al.* (2017)	San Rocco	Lumps	30 fragments of burnt clay plaster were recovered from the side of a hill. Chemical and microscopic analysis of four samples demonstrated the presence of vegetal material. Their use remains unknown, but could potentially be architectural in nature.
ARC-460	1 - Capelli *et al.* (2006)	San Sebastiano di Perti	Lumps	A fired piece of clay daub was recovered.
ARC-461	1 - Rampazzi *et al.* (2007)	Sant'Andrea Priu	Residues	2 samples of paint analysed showed use of egg as a binder for haematite and carbon black pigments. Motifs generally included simple geometric designs - horns, spirals, concentric circles and bands. The results for both samples lay between egg and animal glue, but this was attributed to bacterial contamination.
ARC-462	1 - Kabaciński *et al.* (2015)	Šarišské Michaľany	Residues	Pottery vessels were painted with wood pitch. Internal geometric engravings were filled using a thin layer of matt black pitch, while the external surfaces had a layer of red ochre applied onto which pitch was applied. This ochre layer evened the surface and aided adhesion of the pitch. Microscopic analysis showed presence of a substantial quantity of sand aggregate added intentionally to improve adhesion and durability of the paint layer.

ARC-463	1 - Bacvarov and Gorczyk (2018)	Sarnevo	Lumps	Pits were lined with burnt daub. Other pits were sealed with burnt daub originating from burnt buildings.
ARC-464	1 - Bacvarov and Gorczyk (2018)	Sarnevo	Lumps	Pits were sealed shut with layers of burnt daub from buildings.
ARC-465	1 - Niesiolowska-Śreniowska (1999)	Sarnowo	Lumps	A concentration of burnt clay daub and charcoal intersected by a grave was interpreted as the remains of a building.
ARC-466	1 - Van Gijn (2008); 2 - Van Gijn and Boon (2006)	Schipluiden	Lumps	A lump of adhesive interpreted as birch bark tar mixed with beeswax and plant oil/animal fat bore tooth impressions from chewing, either as a gum or to prepare it for use in hafting.
ARC-467	1 - Van Gijn (2008)	Schipluiden	Microscopic	Nine lithics had small patches of black residue, likely birch bark tar, indicating hafting.
ARC-468	1 - Aveling and Heron (1999)	Segebro	Lumps	1 glossy black lump of chewed pitch, around 4cm long might have been chewed for medicinal or hygenic purposes, or to prepare it for use in hafting/sealing containers.
ARC-469	1 - Goren and Goldberg (1991)	Sha'ar HaGolan	Lumps	A female mud plaster figurine was recovered.
ARC-470	1 - Solecki, Solecki and Agelarakis (2004)	Shanidar	Lumps	Two fragments of burnt daub with impressions from wattle were recovered in association with stone features, perhaps either part of their walls or enclosing walls.
ARC-471	1 - Solecki, Solecki and Agelarakis (2004); 2 - Solecki (1963)	Shanidar	Residues	A chert blade was fixed into a bone haft by its base using a black adhesive resembling bitumen.
ARC-472	1 - Hermansen and Jensen (2011)	Shaqarat Mazyad	Residues	The floors and walls of buildings were plastered. A paved outdoor area was also plastered.

ARC-473	1 - Moore (1978)	Sheikh Ali	Residues	Traces of a plastered floor were present in buildings.
ARC-474	1 - Bartl, Hijazi and Haidar (2006)	Shir	Lumps; Residues	The floors and walls of buildings were coated with lime plaster, frequently replenished with numerous layers in each house.
ARC-475	1 - Bartl, Hijazi and Haidar (2006)	Shir	Residues	The interior of a storage bin containing a skull was lined with plaster.
ARC-476	1 - Nieuwenhuyse, Daskiewicz and Schneider (2020); 2 - Nieuwenhuyse *et al.* (2012)	Shir	Residues	A number of ceramic vessels were also coated with plaster.
ARC-477	1 - Hermansen *et al.* (2006)	Shkârat Msaied	Residues	The floor of a building was originally coated with lime plaster, which was then cut back to lay several burial cists.
ARC-478	1 - Casanova *et al.* (2020)	Sierentz	Microscopic	6 out of 46 pottery sherds analysed had beeswax traces. 46 other sherds had traces of animal fats, 18 had traces of dairy.
ARC-479	1 - Kabaciński *et al.* (2015)	Siniarzewo 1	Residues	Wood pitch adhesive containing mineral impurities was used to waterproof the inner surface of 3 pottery vessels.
ARC-480	1 - Prokeš *et al.* (2009-2010)	Slatinky	Residues	Fragments from two pottery vessels had birch tar on their surfaces. It filled in a number of engraved pits on 1 fragment from the other. Adhesive was moderately degraded from heating at low temperatures.
ARC-481	1 - Prokeš *et al.* (2009-2010)	Slatinky	Residues	Three fragments of one vessel had it used to fix mollusc shells to the surface. Adhesive was moderately degraded from heating at low temperatures.
ARC-482	1 - Ştefan (2018)	Şoimuš - La Avicola	Lumps	Fragmentary ceramic vessels were recovered filled with debris, including pieces of daub impressed with branches and reeds.
ARC-483	1 - Crawford *et al.* (1997)	Sorisdale	Residues	A microlith had a thin line of dark residue adhering to its left face, possibly from a hafting adhesive.

ARC-484	1 - Rimkus (2018)	Spiginas Grave 1	Residues	2 arrowheads found near the grave of an adult male had traces of tar. Likely not associated with the grave due to its' later date.
ARC-485	1 - Vogt (1949)	St. Aubin-Tivoli/Port-Conty	Residues	Pottery vessel from site with geometric patterns painted with birch tar.
ARC-486	1 - Vouga (1928)	St. Aubin-Tivoli/Port-Conty	Residues	1 bone arrowhead and 1 flint blade had bitumen adhering for hafting adhesive.
ARC-487	1 - Vouga (1928)	St. Aubin-Tivoli/Port-Conty	Lumps	Two flint arrowheads found were held within a coil of bitumen - the points of both were broken and evidently held in the bitumen to assist resharpening.
ARC-488	1 - Zhilin (2017); 2 - Zhilin and Matiskainen (2002)	Stanovoye 4	Residues	Blades and microliths were fixed into slotted bone hafts with a dark grey adhesive. One study identified this mixture as conifer pitch mixed with beeswax and charcoal.
ARC-489	1 - Aveling and Heron (1998a); 2 - Roberts, Barton and Evans (1998); 3 - Clark (1954); 4 - Clark *et al.* (1950)	Star Carr	Microscopic	Birch bark tar was present on a flint microlith and the same adhesive was possibly present on two antler points as well.
ARC-490	1 - Clark (1954)	Star Carr	Residues	Pebbles bearing adhesive residues were suggested to be connected to adhesive processing.
ARC-491	1 - Aveling and Heron (1998a); 2 - Roberts, Barton and Evans (1998); 3 - Clark (1954); 4 - Clark *et al.* (1950)	Star Carr	Lumps	Several thin flat cakes of birch bark tar mixed with beeswax and 30% clay attested were probably stored for reuse.
ARC-492	1 - Croft *et al.* (2018)	Star Carr	Microscopic	Another nine lithics bore irregularly distributed and possibly incidental black adhesive residues identified as pine resin mixed with

				charcoal and a white crystalline material that might be bone or a mineral.
ARC-493	1 - Stojanovski *et al.* (2020); 2 - Urem-Kotsou *et al.* (2018)	Starčevo	Microscopic	Another three sherds analysed had beeswax traces, all of which in combination with some proportion of fatty acids - one in high quantity - suggesting mixing of beeswax or honey with animal products. Use of the vessels to process beeswax is possible but unlikely due to the presence of animal fats and their low proportion in the assemblage. 12 sherds (48% of lipids) consisted of dairy products and 1 sherd contained fatty acids and oils deriving from fish.
ARC-494	1 - Urem-Kotsou *et al.* (2018)	Starčevo	Residues	Birch bark tar was used to repair two pottery sherds. The tar was very slightly degraded from heating at low temperatures.
ARC-495	1 - Urem-Kotsou *et al.* (2018); 2 - Urem-Kotsou, Copley and Evershed (2004)	Stavroupoli	Residues	A black linear motif was painted onto the handle of a ceramic jug using black birch bark tar. Another study identified use of pure birch bark tar to paint designs on two pottery sherds.
ARC-496	1 - Urem-Kotsou *et al.* (2018); 2 - Urem-Kotsou, Copley and Evershed (2004)	Stavroupoli	Residues	Black birch bark tar on the exterior of the rim/neck of a jug associated with several holes indicated repair of the vessel. This adhesive using a mixture of birch bark tar and animal fat. Another study identified use of this mixture on another sherd as well as pure birch bark tar on another. Tar was heavily degraded from heating at high temperatures.
ARC-497	1 - Urem-Kotsou *et al.* (2018)	Stavroupoli	Residues	Unidentifiable traces of pure birch bark tar were present on 3 pottery sherds.
ARC-498	1 - Urem-Kotsou *et al.* (2018); 2 - Urem-Kotsou, Copley and Evershed (2004)	Stavroupoli	Residues	The exterior of a carinated bowl was waterproofed with black birch bark tar, with no signs of damage evident. This covered pre-existing incised decorations. Another study identified use of pure birch bark

				tar to waterproof one sherd. Tar was heavily degraded from heating at high temperatures.
ARC-499	1 - Callanan (2013)	Storbreen	Residues	2 intact arrows were recovered from an ice patch, along with 1 fragmented into 3 parts. The fragmented arrow had black adhesive residues bearing imprints from sinew bindings. A slate arrowhead fixed into a wooden shaft was also fixed with adhesive and sinew both at the haft and distal end. Another slate arrow was fixed into pine wood with adhesive and plant lashings.
ARC-500	1 - Torfing (2013); 2 - Madsen and Fiedel (1987)	Store Brokhøj	Lumps	Pieces of burnt clay daub totalling 285kg were recovered - many bearing impressions from wattle. These derived either from building walls or ovens, due to concentrations of daub around ovens. Further daub pieces were recovered from a pit, interpreted as rubbish dumped from unsuccessful firing episodes.
ARC-501	1 - Bartík *et al.* (2019)	Stránska skála	Lumps	Lumps of daub - mostly bearing wood impressions - were recovered from two buildings.
ARC-502	1 - Rampazzi *et al.* (2007)	Su Littu	Residues	A sample of paint analysed showed use of egg as a binder for carbon black pigment. Motifs included simple geometric designs - horns, spirals, concentric circles and bands. The result for another sample, deriving from haematite pigment, was inconclusive due to poor preservation.
ARC-503	1 - János and Judit (2012)	Suplacu de Barcau	Residues	Chemical analysis of an unstated sample of painted ceramic fragments identified the presence of birch tar.
ARC-504	1 - Wojtczak and Kerdy (2018)	Sutz-Lattrigen Aussen	Residues	1 bone point had residues of birch bark tar at its base, preserving impressions of vegetal binding.

ARC-505	1 - Robson *et al.* (2019)	Šventoji 1	Microscopic	A mixture of birch bark tar and animal fat was identified in one sherd.
ARC-506	1 - Osipowicz *et al.* (2020)	Šventoji 3	Residues	An engraved zoomorphic staff made from elk antler had resin forming the shape of an eye, either as paint or to sketch out marks for incision. Other designs on the staff appeared incomplete.
ARC-507	1 - Iršėnas *et al.* (2018)	Šventoji 3	Microscopic	A harp seal cranium possibly modified for use in ritual activities had a patch of tar covering a fracture surface, possibly to attach unknown items.
ARC-508	1 - Heron *et al.* (2015)	Šventoji 4	Microscopic	A globular amphora had traces of conifer resin or tar for waterproofing and fatty acids indicate an aquatic product was stored within. A second amphora had beeswax traces which might derive from waterproofing or the storage of honey which was absorbed into the sherd.
ARC-509	1 - Iršėnas *et al.* (2018)	Šventoji 6	Microscopic	Resin traces were found in engraved pits on an antler/bone fish spear.
ARC-510	1 - Aveling and Heron (1998b); 2 - Coles, Hibbert and Orme (1973)	Sweet Track F	Residues	The base of an arrowhead bore fragmentary traces of birch tar.
ARC-511	1 - Raemaekers, Kubiak-Martens and Oudemans (2013)	Swifterbant S3	Residues	1 pottery vessel contained beeswax and animal/plant lipids, another contained animal fats, protein and a trace amount of resin that likely derives from modern root material. Sherds from a further 14 vessels contained animal/plant lipids and animal protein suggestive of cooking. No evidence of dairy use was present.
ARC-512	1 - Jensen *et al.* (2019)	Syltholm	Lumps	A lump of chewed birch tar was subjected to radiocarbon and DNA analysis revealing a human genome and various bacterial/viral

				genomes. It had been chewed either to make it pliable before use or as a chewing gum for medicinal purposes.
ARC-513	1 - Kreiter, Pető and Pánczél (2013)	Szakmár–Kisülés	Lumps	Analysis of a sample of plaster from the site found it to consist of three layers, mostly fine grained but the third contained more inclusions. All contained some degree of vegetal temper.
ARC-514	1 - Gyucha *et al.* (2015); 2 - Luthern (2012)	Szeghalom-Kovácshalom	Lumps	Concentrations of daub (totalling 1732.6kg of material) indicated the presence of rectangular buildings.
ARC-515	1 - Peros (2000)	Tabaqat al-Buma	Residues	134 sickle blades bore traces of a calcareous substance, which might be a hafting adhesive such as lime plaster.
ARC-516	1 - Roustaei, Mashkour and Tengberg (2015)	Tappeh Sang-e Chakhmaq	Residues	The floors of houses were finely plastered with gypsum.
ARC-517	1 - Masuda *et al.* (2013)	Tappeh Sang-e Chakhmaq	Residues	Sickle blades were set into bone hafts using bitumen. Many of these hafts were decorated with animal carvings.
ARC-518	1 - Anderson (1890)	Täuffelen	Residues	Flint knives and saws were fixed in wooden hafts with bitumen.
ARC-519	1 - Goren and Goldberg (1991)	Tel Dan	Lumps	A white ware vessel consisting of lime plaster mixed with clay and pieces of limestone was recovered.
ARC-520	1 - Goren and Goldberg (1991)	Tel Teo	Lumps	A fragment of lime plaster white ware was also recovered.
ARC-521	1 - Goren and Goldberg (1991)	Tel Teo	Residues	Walls were plastered with a mixture of mud and lime plaster with crushed calcite and vegetal material.
ARC-522	1 - Al-Nahar (2006)	Tell Abu as-Sawwan	Residues	The floors of buildings were coated with white or yellowish plaster, in some instances mixed with clay, mud and aggregates. These were often coloured red with ochre.

ARC-523	1 - Al-Nahar (2006)	Tell Abu as-Sawwan	Residues	A mortar consisting of mud, plaster chunks, gravel and pebbles was used to fix a wall together.
ARC-524	1 - Rehhoff *et al.* (1990)	Tell al-Raqai	Lumps	Fragments of possible wall plaster were found near a passageway.
ARC-525	1 - Cauvin (1983); 2 - Cauvin (1973)	Tell Assouad	Residues	Black adhesive residue (possibly bitumen) was present on sickle blades.
ARC-526	1 - Stordeur and Khawam (2007); 2 - Moore (1978)	Tell Aswad	Lumps	A few fragments of plaster were recovered. Caches of plastered skulls painted with red ochre were also recovered.
ARC-527	1 - Moore (1978)	Tell Bouqras	Lumps	Two fragments of white plaster ware were recovered.
ARC-528	1 - Akkermans *et al.* (1983); 2 - Moore (1978)	Tell Bouqras	Residues	The floors and walls of buildings were plastered with gypsum or mud. Floors had a preliminary layer of softer grey gypsum plaster applied before a whiter finishing coat of hard white gypsum plaster. Some floors surfaces had impressions from mats present.
ARC-529	1 - Roodenberg (1983)	Tell Bouqras	Residues	Bitumen was present on the back of a number of lithics.
ARC-530	1 - Rehhoff *et al.* (1990)	Tell Damishliyya	Residues	A thick coating of gypsum plaster was present on the interior of two coarse ceramic vessels.
ARC-531	1 - Moore (1978)	Tell el'Far'ah	Residues	Part of the floor of one building was plastered.
ARC-532	1 - Van de Velde (2015b)	Tell el'Oueili	Lumps	Various pieces of bitumen have been found with impressions of matting or formed into small spherical objects. Geochemical analysis of 32 bitumen samples demonstrated they originated from Khuzestan during the earlier half of the period, but derived from Northern Iraq in the later half.

ARC-533	1 - Anderson (1994); 2 - Hole (1994)	Tell Feyda	Residues	Three flakes (one flint, two chert) were used as sickle blades bore bitumen residues. Microscopic analysis indicated the flint flake had first been used as a sickle blade to harvest cereals, then as an insert in a threshing tool (perhaps on a sledge).
ARC-534	1 - Fortin (1994)	Tell Gudeda	Residues	The floors and walls of buildings were plastered with gypsum. One building also had bitumen applied to floor surfaces.
ARC-535	1 - Miller (1983)	Tell Hadidi	Residues	Gypsum plaster was used to fix the backed portion of a chisel-ended arrowhead into its haft.
ARC-536	1 - Molist *et al.* (2013)	Tell Halula	Residues	The floors of buildings were infrequently plastered.
ARC-537	1 - Borrell and Stefanisko (2016); 2 - Borrell and Molist (2007)	Tell Halula	Residues	115 sickle blades bore traces of bitumen on their backed edges (52% of the total number). These were fixed into curved wooden hafts - melted bitumen was placed into incisions before sickle blades were added, with additional bitumen applied around the blade. Three axeheads discovered in two graves also bore bitumen adhesive. Twelve projectile points and three fragmentary projectile points bore lime plaster residues, with one preserving a series of incised longitudinal marks that could result from use of a tool to remove excess material or the negative of a covering material - either textile wrapping or a hollowed haft of wood or horn. No adhesive traces were recovered from other tool forms. Differential use of hafting adhesives is suggested - bitumen for sickle blades to allow their easy replacement due to frequent breakage and lime plaster for arrowheads to detach upon impact and also preserve their wooden hafts (more time-consuming to produce) for recovery.

ARC-538	1 - Borrell and Stefanisko (2016); 2 - Borrell and Molist (2007)	Tell Halula	Lumps	Lumps of bitumen with reed impressions were also recovered, indicative of use to waterproof basketry.
ARC-539	1 - Nishiaki (2018)	Tell Kashkashok I	Residues	Black bitumen and/or sickle gloss present on the backed edge of 14 lithic blades.
ARC-540	1 - Van de Velde (2015b); 2 - Connan *et al.* (2005)	Tell Kosak Shamali	Lumps	Large slabs of black bitumen with reed or palm imprints on one side were found within a storage chamber. They were interpreted as deriving from boats rather than roofs, due to their thickness and use of wooden planks in the storage chamber for roofing. They included sand/quartz and on average around 19% vegetal matter to improve their mechanical properties (preventing sweating at high temperatures, extending the material and allowing handling at lower temperature. The same style of composition was used for sealing baskets at the site. Geochemical analysis demonstrated the bitumen derived from the Hit source in Northern Iraq, although some could have derived from Southern Turkey. Further ceochemical analysis of 12 pieces of bitumen showed they derived from 3 different sources: 5 from Hit in Northern Iraq, 4 from Northern Iraq and 3 from Samsat in Southern Turkey.
ARC-541	1 - Van de Velde (2015b); 2 - Connan *et al.* (2005)	Tell Kosak Shamali	Residues	Ceramic sherds encrusted with bitumen were also recovered.
ARC-542	1 - Moore (1978)	Tell Labweh	Lumps	A large quantity of white plaster ware was found, either flared bowls or cylindrical jars.
ARC-543	1 - Moore (1978)	Tell Labweh	Lumps; Residues	The floors of buildings were coated with red or white plaster.

ARC-544	1 - Bader (1993)	Tell Maghzaliyah	Lumps	Various plaster dishes and jugs were constructed from plaster.
ARC-545	1 - Bader (1993)	Tell Maghzaliyah	Residues	Internal walls and floors of buildings were plastered with gypsum plaster, with multiple coats (in some cases 2-3cm thick) attesting frequent replasterings. Larger buildings had partitions made from stones/wooden panels covered with gypsum or mud plaster. One structure had three oval gypsum plaster basins, of hollowed stone lined with plaster. Pieces of gypsum plaster originating from building roofs bore impressions from reeds.
ARC-546	1 - Bader (1993)	Tell Maghzaliyah	Lumps	2 obsidian flakes, which acted as sickle blades, pressed into a piece of bitumen which served as a haft.
ARC-547	1 - Bader (1993)	Tell Maghzaliyah	Residues	A storage pit was carefully lined with gypsum plaster.
ARC-548	1 - Bader (1993)	Tell Maghzaliyah	Lumps	Pieces of gypsum plaster and bitumen with reed and woven material impressions attest use to seal a diverse array of items: reed containers, a tray made from twigs intertwined with thin cord, woven mats used as floor covers and small woven bags.
ARC-549	1 - Pedersen (1994)	Tell Mashnaqa	Residues	Bitumen present on a large number of the sickle blades recovered.
ARC-550	1 - Rehhoff *et al.* (1990)	Tell Mounbatah	Lumps	Two fragments of white ware were recovered bearing woven reed impressions on their exterior surfaces, indicating they had been made in reed baskets.
ARC-551	1 - Duistermaat and Schneider (1998)	Tell Mounbatah	Lumps	A clay stamp used to seal a container was chemically analysed.

ARC-552	1 - Balbo *et al.* (2012)	Tell Qarassa	Lumps	Pieces of burnt clay daub from the collapsed roof of a building were recovered.
ARC-553	1 - Banning and Najjar (1999)	Tell Rakan I	Residues	Dark residue present on a ceramic handle fragment might be a resin.
ARC-554	1 - Kingery, Vandiver and Prickett (1988); 2 - Moore (1978); 3 - Gourdin and Kingery (1975)	Tell Ramad	Lumps	A bowl made from lime and gypsum plaster mixed with calcite was recovered and fragments of three more white ware bowls were recovered consisting of lime plaster mixed with mineral (limestone, charcoal, quartz) and vegetal aggregates.
ARC-555	1 - Moore (1978); 2 - Gourdin and Kingery (1975)	Tell Ramad	Residues	Several caches of plastered skulls were recovered, often coated with red ochre.
ARC-556	1 - Moore (1978); 2 - Gourdin and Kingery (1975)	Tell Ramad	Residues	The floors of buildings were plastered with lime.
ARC-557	1 - Connan *et al.* (2004)	Tell Sabi Abyad I	Residues	Geochemical analysis of bitumen used to paint black linear designs on 6 ceramic sherds demonstrated that samples taken from 3 potsherds derived from Zakho and 1 sample from Kirkuk, both in northern Iraq. An exact source could not be identified for the remaining 4 samples taken, although 2 might also have derived from northern Iraq.
ARC-558	1 - Duistermaat and Schneider (1998); 2 - Rehhoff *et al.* (1990); 3 - Akkermans (1987)	Tell Sabi Abyad I	Residues	The floors and walls of buildings were coated with various mixtures of gypsum, lime or mud plaster. One circular building had its interior walls made from gypsum plaster, while the exterior was coated with more stronger lime plaster. A bench was also covered with this plaster and the interior of a kiln was plastered with mud.
ARC-559	1 - Akkermans and Cavallo (1999)	Tell Sabi Abyad I	Residues	Black adhesive (likely bitumen) was present at the base of two flint arrowheads, one of which was embedded in the shoulder blade of an aurochs.

ARC-560	1 - Duistermaat and Schneider (1998); 2 - Akkermans and Duistermaat (1996); 3 - Rehhoff *et al.* (1990)	Tell Sabi Abyad I	Lumps; Residues	Chemical analysis of plaster around the rim of a pit, perhaps to seal water or food for preservation, identified as pure gypsum plaster. Containers and other objects (pottery vessels, baskets, mats, stone bowls, leather bags) were sealed shut to protect their contents or marked with clay. Seal designs were then impressed into the clay surface. One third of clay seals derived from pottery vessels, another third from baskets and most of the remaining third were of indeterminate purpose. 1 leather bag was marked as well as a handful of plaited mats.
ARC-561	1 - Copeland and Verhoeven (1996)	Tell Sabi Abyad II	Residues	Adhesive residues, likely from bitumen, were present on either the bases or mid-sections of sickle blades, either in the form of a flattened lump or stains.
ARC-562	1 - Copeland and Verhoeven (1996)	Tell Sabi Abyad II	Lumps	2 pieces of bitumen bore reed impressions suggesting coating of woven basketry.
ARC-563	1 - Gencheva (1992)	Tell Samovodene	Residues	Engravings on ceramic vessels, religious tablets and anthropomorphic/zoomorphic figurines were filled with a white mixture of lime plaster and quartz.
ARC-564	1 - Gencheva (1992)	Tell Samovodene	Residues	The floors and walls of buildings were plastered.
ARC-565	1 - Gencheva (1992)	Tell Samovodene	Residues	A ceramic vessel was found filled with a carbonised white substance identified as pure slaked lime. A kiln found at the northern end of the tell with no evidence for use in cooking or pottery manufacture could have been used in lime production.
ARC-566	1 - Nishiaki (2007)	Tell Seker al-Aheimar	Residues	A clay female figurine had multiple layers of mud plaster applied to it. It was uncovered beneath the gypsum plaster floor of a building.

ARC-567	1 - Portillo *et al.* (2014); 2 - Portillo *et al.* (2010)	Tell Seker al-Aheimar	Residues	The floors of houses were plastered with gypsum. A gypsum-plastered channel ran from a central room to an open space in the eastern part of a building.
ARC-568	1 - Portillo *et al.* (2014); 2 - Portillo *et al.* (2010)	Tell Seker al-Aheimar	Residues	Storage bins were also coated with gypsum plaster.
ARC-569	1 - Covello-Paran (2019)	Tell Yosef	Residues	The surfaces of a rectangular pit were plastered.
ARC-570	1 - Jayez and Garazhian (2013)	Tell-e Atashi	Residues	Black adhesive present on the backed portion of some lithics. This may be bitumen or an unidentified adhesive material in combination with animal fat and charcoal.
ARC-571	1 - Nishiaki (1995)	Telul eth-Thalathat	Residues	Adhesive residue present on 2 sickle blades.
ARC-572	1 - Whitlam, Valipour and Charles (2019)	Tepe Khaleseh	Residues	The walls of houses were plastered with a mixture of mud and straw.
ARC-573	1 - Gregg (2009); 2 - Gregg, Brettell and Stern (2007)	Tepe Tula'i	Lumps	Geochemical analysis performed on 3 pieces of earth encrusted with bitumen indicated they derived from the nearby Deh Luran source in Khuzestan. These were brown, yellowish-brown and pinkish-brown in colour.
ARC-574	1 - Tóth *et al.* (2020)	Têšetice-Kyjovice	Lumps	Pieces of highly fragmentary daub from buildings were recovered.
ARC-575	1 - Prokeš *et al.* (2009-2010)	Têšetice-Kyjovice	Residues	A broken flint blade had significant birch bark tar residues. Tar was moderately degraded from heating at medium temperatures.
ARC-576	1 - Prokeš *et al.* (2009-2010)	Têšetice-Kyjovice	Lumps	Various pieces of birch bark tar were also recovered. Tar was moderately degraded from heating at medium temperatures.

ARC-577	1 - Roberts, Barton and Evans (1998); 2 - Wymer and King (1962)	Thatcham III	Residues	Adhesive was present on the dorsal face of an unretouched flake, maybe a resin and possibly deposited accidentally due to a nearby burnt patch.
ARC-578	1 - Roberts, Barton and Evans (1998); 2 - Wymer and King (1962)	Thatcham III	Lumps	A lump of unidentified adhesive was also attested.
ARC-579	1 - Roffet-Salque *et al.* (2015)	Théopetra	Microscopic	Beeswax present on 1 out of 18 sherds identified as bearing residues (6% of total residues present).
ARC-580	1 - Saile, Sedlmaier and Dębiec (2018)	Tiefbrunn	Residues	Birch bark tar covered older incised decorations on a pottery sherd, with four oval triangle impressions in the tar likely deriving from birch bark or other material pressed into it.
ARC-581	1 - Domboróczki (2010); 2 - Veronika and György (2007)	Tiszaszőlős-Domaháza	Residues	The floor of a building was partially (remains) plastered with clay.
ARC-582	1 - Kabaciński *et al.* (2015)	Tominy 6	Residues	Wood tar mixed with a mineral component for better adhesion was used to repair broken vessels. Tar was slightly degraded and had a lack of microporous structures, suggesting it was produced via a two chamber method at lower temperatures (under 300°C).
ARC-583	1 - Özdoğan and Dede (1998)	Toptepe	Lumps; Residues	The floors and walls of buldings were plastered.
ARC-584	1 - Roffet-Salque *et al.* (2015)	Toptepe	Microscopic	Beeswax present on 2 out of 8 sherds identified as bearing residues (25% of total residues present).
ARC-585	1 - Henry and Garrard (1988)	Tor Hamar	Residues	Red and yellow ochre residues present on 130 lithics, either along their backed edges or covering most of the tool.
ARC-586	1 - Urem-Kotsou *et al.* (2018)	Toumba Kremastis Koiladas	Residues	A sample taken from a ceramic sherd showed it had been waterproofed with pine bark tar mixed with animal fat.

ARC-587	1 - Chriazomenou, Papoulia and Kopaka (2014)	Tsirmiris	Microscopic	A flint sickle blade had adhesive traces ranging from white-yellow to dark red-brown adhering to its back, with preliminary chemical analyses suggesting a similarity to amber and related resins. A small piece of a wooden haft remained adhering to the resin.
ARC-588	1 - Erdoğu (2017)	Uğurlu	Lumps; Residues	The floors of buildings were plastered with clay or lime plaster. A sunken oval basin was plastered with mud.
ARC-589	1 - Draşovean *et al.* (2017)	Uivar	Residues	The floors and walls of buildings were plastered.
ARC-590	1 - Pawlik (2004)	Ullafelsen	Microscopic	Birch bark tar was identified on a number of lithics. Although ash was present, this was interpreted as incidental resulting from preparation.
ARC-591	1 - Erol (2019); 2 - Guilbeau *et al.* (2019); 3 - Çilingiroğlu *et al.* (2004)	Ulucak Höyük	Lumps; Residues	Pise/mudbrick buildings had their walls and floors covered with mud plaster, occasionally lime plaster, on their interior and exterior faces. Lumps of plaster in courtyards indicated the presence of enclosing walls. Chemical analysis of fourteen plaster samples deriving from eight buildings (6 floor plasters, 5 interior wall plasters and 3 exterior wall plasters) revealed nearly all wall plasters containined kaolinite and mica-illite clay for a finer finish and contained less coarse aggregate than floor plasters. However, one sample lacked these components and was more similar to floor plasters with 26% coarse aggregate included. The samples ranged widely in colour with 4 being pale brown, 4 pink, 1 light red and 1 pale yellow. Ovens/hearths had their bases lined with pebbles covered over with plaster and one building had a lime-plastered trough.
ARC-592	1 - Ivanovaitė *et al.* (2018)	Vaikantonys	Residues	A black pitch-like adhesive material was present at the base of a slotted bone point as well as its flint inserts.

ARC-593	1 - Roffet-Salque *et al.* (2015)	Vassilara Rachi	Microscopic	Beeswax was present on 1 sherd identified as bearing residues (100% of total residues present).
ARC-594	1 - Řídký *et al.* (2014)	Vchynice	Lumps	18.23kg of daub was recovered from the upper part of a ditch. Many pieces bore impressions from wood.
ARC-595	1 - Prokeš *et al.* (2009-2010)	Vedrovice	Residues	An engraved pit on a ceramic fragment was filled with birch bark tar for decorative purposes. Tar was moderately degraded from heating at medium temperatures.
ARC-596	1 - Salisbury and Morris (2009); 2 - Sarris *et al.* (2004); 3 - Parkinson, Gyucha and Yerkes (2002)	Vésztő-Bikeri	Lumps	Pieces of burnt daub marking the boundaries of three buildings were recovered.
ARC-597	1 - Oras *et al.* (2017)	Vihasoo III	Microscopic	Traces of unidentified resin were identified on 5 sherds.
ARC-598	1 - Tasić *et al.* (2015); 2 - Filipovic and Maric (2013)	Vinča-Belo Brdo	Lumps	Pieces of daub bearing reed impressions originating from building walls or roofs were recovered.
ARC-599	1 - Cristiani, Dimitrijević and Vitezović (2016)	Vinča-Belo Brdo	Lumps; Residues	Red, yellow and dark grey residues were present on the upper and lower portions of bone fish hooks, which were interpreted as resin based on their appearance and inclusions. Adhesive present on upper portions secured lashings, the lower portions possibly fixed a decayed second component due to the presence of surviving vegetal fibres. The lower residues could also have derived from a wooden support lashed with vegetal threads that reinforced the bone shaft.
ARC-600	1 - Spurrell (1892)	Vinelz	Residues	Pitch was used to insert 3 small lithics into a wooden haft. Experiments suggested this tool could not have been used as a saw as previously suggested.

ARC-601	1 - Martín-Gil *et al.* (2003)	Virgen de Siete Iglesias	Microscopic	Brown residue was present on the inner face of a bead
ARC-602	1 - Cristiani, Živaljević and Borić (2014)	Vlasac	Residues	Residues of a compound incorporating red ochre were attested at the top of 239/269 suspended cyprinid teeth recovered from an infant burial.
ARC-603	1 - Beneš *et al.* (2018)	Vrbjanska Čuka	Lumps	A sizeable quantity of daub fragments were recovered from buildings. One large building interpreted as a sanctuary had an "altar" structure comprised of daub.
ARC-604	1 - Rollefson *et al.* (2016)	Wadi al-Qattafi	Residues	Two shallow oval basins, one immediately below the other, were plastered with gypsum mixed with charcoal.
ARC-605	1 - Schick (1995)	Wadi Murabba'at	Residues	A patchy layer of bitumen was present on both sides of a wooden comb, which added durability and might also have fixed the comb onto woven material or a handle. It was unlikely to have been used to comb hair due to the bitumen coating - its proportions do not seem appropriate for use on hair and the attrition/polish present would not have derived from combing hair. It might possibily have been used as a combing or hackling tool for textiles or a "beater-in" for small-scale twinning work or basket making.
ARC-606	1 - Simmons *et al.* (2001)	Wadi Shu'eib	Residues	The floors of buildings were plastered.
ARC-607	1 - Al Nahar (2014); 2 - Simmons *et al.* (2001)	Wadi Shu'eib	Lumps	Several anthropomorphic figurines were made from plaster. Rings were produced from bitumen and 20 plaster beads were found in a burial.
ARC-608	1- Keller (1866)	Wangen-Hinterhorn	Residues	Flint blades were glued to preserved hafts with bitumen. Bone arrowheads also bore traces of bitumen.

ARC-609	1- Keller (1866)	Wetzikon-Robenhausen	Lumps	A small "drinking-cup" was also made from bitumen.
ARC-610	1- Keller (1866)	Wetzikon-Robenhausen	Residues	A flint arrowhead was fixed to its shaft with bitumen and cord.
ARC-611	1 - Mithen (2020); 2 - Flohr *et al.* (2015); 3 - Finlayson, Mithen and Najjar (2012); 4 - Finlayson *et al.* (2011); 5 - Mithen *et al.* (2011)	WF16	Residues	The walls and floors of buildings were plastered with mud. Deep troughs designed to carry liquids off floor surfaces and a bench were also plastered.
ARC-612	1 - Rollefson, Rowan and Wasse (2014)	Wisad Pools	Residues	The floor of a building was plastered with gypsum. A basalt pavement outside another building was plastered with gypsum.
ARC-613	1 - Salque *et al.* (2013)	Wolica Nowa 1	Microscopic	Beeswax and animal fat were identified on a ceramic sieve.
ARC-614	1 - Kostadinova-Abramova, Kovacheva and Jordanova (2016); 2 - Popova (2014)	Yabalkovo	Lumps	Ten samples of fired clay plaster from one oven and four hearths were subjected to archaeometric dating. A further 50 pieces of daub were recovered from a pit.
ARC-615	1 - Merpert and Munchaev (1987); 2 - Merpert and Munchaev (1973)	Yarim Tepe I	Residues	Plaster was used to coat the packed earth walls and floors of buildings, sometimes with successive layers up to 1.5cm thick. A platform was plastered. Mortars were also fixed in place using plaster. The surfaces of passages linking houses were also plastered. A raised platform was plastered using gypsum and floor plaster consisted of clay mixed with chopped straw and gypsum for added strength. Plaster use is less frequent at earlier levels of the site.
ARC-616	1 - Merpert and Munchaev (1993); 2 - Merpert and	Yarim Tepe II	Residues	Buildings were infrequently plastered, with only occasional interior and exterior coating of the floors and walls of mudbrick buildings

	Munchaev (1987); 3 - Merpert and Munchaev (1973)			using clay plaster. Wall plaster was typically painted red and was typically quite thick (up to 4cm) where it did occur. A non-domestic building (possibly religious in nature or a public ediface) made from clay was plastered.
ARC-617	1 - Merpert and Munchaev (1973)	Yarim Tepe II	Residues	Bitumen was used to fix flint and obsidian sickle blades into stone or bone hafts, sometimes set at an angle to provide a serrated cutting edge.
ARC-618	1 - Goren and Goldberg (1991)	Yiftahel	Lumps	4 white ware vessels - one consisting of lime plaster mixed with powdered chalk, anhydrite crystals and clay and the other three a mixture of clay and powdered chalk - were recovered.
ARC-619	1 - Slon *et al.* (2014); 2 - Khalaily *et al.* (2008); 3 - Milevski *et al.* (2008)	Yiftahel	Residues	Burials were placed under plastered floors. A cache of three plastered skulls was recovered from a pit located north of one building. The best-preserved skull had a mask of plaster covering the whole face, while the other two had plastered eye-sockets in which pearl shells and flint flakes were inserted to depict eyes.
ARC-620	1 - Khalaily, Milevski and Barzilai (2013); 2 - Poduska *et al.* (2012); 3 - Khalaily *et al.* (2008); 4 - Khalaily *et al.* (2005); 5 - Goren and Goldberg (1991); 6 - Ronen, Bentur and Soroka (1991); 7 - Kingery, Vandiver and Prickett (1988); 8 - Garfinkel (1987); 9 - Hershkovitz, Garfinkel and	Yiftahel	Lumps; Residues	The floors of all buildings were plastered thickly, with analysis of a floor from one building showing use of an almost pure lime plaster containing no aggregate content to form two layers - an initial base layer 45mm thick and a finishing layer 5mm thick. Chemical analysis of 40 samples of plaster indicated finer white finishing layers applied over yellow-red layers including more aggregate content. Further analysis indicated incorporation of ash into one sample. Lumps of mud bearing impressions from branches and plants found strewn in the interior of buildings appear to represent coatings applied to roofs. Open courtyards were also plastered.

	Arensburg (1986); 10 - Garfinkel (1985)			
ARC-621	1 - Khalaily, Milevski and Barzilai (2013)	Yiftahel	Residues	Bitumen residues present on the ventral face of 4 large flakes and a dark-coloured adhesive (either tar or collagenaceous in nature) was used to fix a sickle blade into a bone haft.
ARC-622	1 - Goren and Goldberg (1991)	Yiftahel	Lumps	A lump of lime plaster containing impressions from vegetal material was also recovered.
ARC-623	1 - Edwards and Schmidt (2021)	Zahrat adh-Dhra‘ 2	Residues	The floors of three structures were plastered, one specifically with lime plaster. The hearth of one building was made of stones set in plaster.
ARC-624	1 - Bondár (1995)	Zalaszentbalázs-Szölöhegyi	Lumps	Pieces of burnt clay daub bearing impressions from wattle represented former buildings.
ARC-625	1 - Manhita *et al.* (2014)	Zambujeiro	Microscopic	A unstated percentage of 7 samples taken from ceramic sherds bore traces of pine resin. These residues could have originated from use in sealing, repair or flavouring materials stored within the vessels.
ARC-626	1 - Bondetti *et al.* (2020)	Zamostje 2	Microscopic	Traces of resin were detected on 25 ceramic sherds and a further 18 foodcrusts present on ceramics.
ARC-627	1 - Pelisiak (2015)	Zduńska Wola-Nowe Miasto	Lumps	Three concentrations of daub were interpreted as the remains of three buildings.
ARC-628	1 - Kramberger (2010)	Zgornje Radvanje	Lumps	Pieces of burnt daub represented the remains of collapsed buildings indicated by postholes. Several pits contained pieces of burnt daub in their infill.
ARC-629	1- Goldman and Szénászky (1994)	Zsadány-Püski-Hügel	Residues	2 cups and 1 bowl found built into a wall beneath a house interpreted as a construction offering had bitumen traces. The inner and outer surfaces of the cups were coated with bitumen that covered older

				incised decoration, with their inner surfaces also having red colour under the bitumen. The inner rim of the bowl had a 6cm layer of bitumen with 4 symmetrical patterns made in it using organic material glued to the vessel. Red colour was preserved well under the bitumen, but very pale elsewhere. The exterior had a small 1cm imprint of bitumen just below the rim. In addition to this offering, various fragments of ceramic elsewhere at the site had bitumen present if well preserved as residues, or as brownish/brownish-grey traces if not as well preserved.
ARC-630	1 - Pietrak (2019)	Żuławka 13	Lumps	Several dozen lumps of birch tar were also recovered, both matt and glossy in nature, with some containing fragments of bark or wood from their production. Some of these contained impressions from human teeth, possibly attesting chewing of gums for medicinal reasons. Analysis of 5 samples found 4 were comprised of birch wood tar, two of these also containing animal fat, while one consisted of birch bark tar. 1 sample of tar was heavily degraded from heating at high temperatures. The remaining 5 experienced medium heating. Lumps contained pieces of bark or wood from their manufacture.
ARC-631	1 - Pietrak (2019)	Żuławka 13	Residues	Traces of birch bark tar were present on fragments of ceramics to repair breaks. These residues were present on the interior of 1 sherd and the outer surfaces of 2 sherds, with 1 sherd having adhesive on both faces. Chemical analysis of 5 tar samples demonstrated 4 derived from birch wood while one derived from birch bark.

Table 10. Specific adhesive data.

Record ID	Site Name	General Use	Specific Use	General Adhesives	Specific Adhesives	Additives	Analytical Techniques
ARC-001	Abu Gosh	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-002	Abu Hureyra	Application	Architectural	Plaster	Mud Plaster	N	No Analysis (3); Physical Examination (1; 2; 4)
ARC-003	Abu Hureyra	Application	Sealing	Bitumen; Plaster	Bitumen; Mud Plaster	N	Physical Examination (1; 2)
ARC-004	Abu Hureyra	Application	Sealing	Bitumen; Plaster	Bitumen; Unidentified Plaster	N	No Analysis (1); Physical Examination (2)
ARC-005	Abu Hureyra	Unknown	Unknown	Plaster	Gypsum Plaster	N	Chemical Analysis (1)
ARC-006	Abu Hureyra	Manufacture	Container Manufacture	Plaster	Gypsum Plaster	Charcoal, Gypsum, Limestone and Sandstone (Gypsum Plaster)	Chemical Analysis (1); No Analysis (2)
ARC-007	Adh Dhaman	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-008	Ageröd I	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-009	Ain as-Sayh	Application	Architectural	Plaster	Lime Plaster	N	Chemical Analysis (2); No Analysis (1); Physical Examination (3)

ARC-010	Ain as-Sayh	Application	Caulking	Bitumen	Bitumen	N	Chemical Analysis (2); No Analysis (1); Physical Examination (3)
ARC-011	Ain as-Sayh	Processing/ Production	Processing	Bitumen	Bitumen	N	Physical Examination (1; 2)
ARC-012	Ain Ghazal	Application	Architectural	Plaster	Lime Plaster; Mud Plaster	N	Chemical Analysis (5); No Analysis (1; 2; 4; 6; 7; 10); Physical Examination (3; 8; 9; 11)
ARC-013	Ain Ghazal	Gluing	Architectural	Plaster	Lime Plaster	N	No Analysis (1); Physical Examination (2)
ARC-014	Ain Ghazal	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-015	Ain Ghazal	Application	Sealing	Plaster	Lime Plaster; Mud Plaster	N	No Analysis (1); Physical Examination (2)
ARC-016	Ain Ghazal	Application	Unknown	Plaster	Unidentified Plaster	N	No Analysis (1); Physical Examination (2)
ARC-017	Ain Ghazal	Manufacture	Container Manufacture	Plaster	Unidentified Plaster	N	No Analysis (1; 2; 4); Physical Examination (3)
ARC-018	Ain Ghazal	Application	Object Decoration	Bitumen; Plaster	Bitumen; Unidentified Plaster	N	Chemical Analysis (4); Optical Microscopy (5); Physical Examination (1; 2; 3; 4; 5; 6)
ARC-019	Ain Ghazal	Application	Object Manufacture	Plaster	Lime Plaster; Unidentified Plaster	N	Chemical Analysis (6); No Analysis (4; 7; 9); Optical Microscopy (6); Physical Examination (1; 2; 3; 5; 8; 10; 11; 12; 13; 14)

ARC-020	Ain Ghazal	Manufacture	Object Manufacture	Plaster	Unidentified Plaster	N	No Analysis (1; 2; 4); Physical Examination (3; 5; 6; 7)
ARC-021	Ain Mallaha	Application	Architectural	Plaster	Lime Plaster	N	Chemical Analysis (2); No Analysis (1)
ARC-022	Ain Mallaha	Gluing	Hafting	Resin	Unidentified Resin	N	Optical Microscopy (1); Physical Examination (1)
ARC-023	Ais Giorkis	Application	Architectural	Plaster	Chalk Plaster; Unidentified Plaster	N	No Analysis (1)
ARC-024	Ajdovska Jama	Burning	Incense	Tar	Unidentified Tar	N	Chemical Analysis (1)
ARC-025	Ajdovska Jama	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-026	Akali	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-027	Ali Kosh	Application	Architectural	Bitumen; Plaster	Bitumen; Gypsum Plaster; Mud Plaster	Quartz (Clay Plaster); Clay Plaster (Gypsum Plaster); Quartz (Gypsum Plaster)	Chemical Analysis (1); Physical Examination (2)
ARC-028	Ali Kosh	Gluing	Hafting	Bitumen	Bitumen	N	Optical Microscopy (1); Physical Examination (2)
ARC-029	Ali Kosh	Processing/ Production	Processing	Bitumen	Bitumen	Ochre (Bitumen)	Physical Examination (1)

ARC-030	Ali Kosh	Application/ Unknown	Sealing/ Storage	Bitumen	Bitumen	N	Chemical Analysis (1; 2)
ARC-031	Ali Kosh	Application	Sealing	Bitumen	Bitumen	N	Chemical Analysis (1); Physical Examination (2)
ARC-032	Ali Kosh	Manufacture	Object Manufacture	Bitumen	Bitumen	N	Physical Examination (1)
ARC-033	Alsónyék	Application	Architectural	Plaster	Unidentified Plaster	Quartz, Feldspar and Mica (Unidentified Plaster); Quartz, Feldspar, Mica and Vegetal Material (Unidentified Plaster)	No Analysis (2; 4); Optical Microscopy (3); Physical Examination (1)
ARC-034	Altscherbitz	Chewing	Medicinal/ Processing	Tar	Unidentified Tar	N	Physical Examination (1)
ARC-035	Altscherbitz	Gluing	Repairing	Tar	Unidentified Tar	N	Optical Microscopy (1); Physical Examination (1)
ARC-036	Altscherbitz	Application	Container Decoration	Tar	Unidentified Tar	N	Optical Microscopy (1); Physical Examination (1)
ARC-037	Am Wiesenberg	Gluing	Hafting	Tar	Birch Bark Tar	N	Optical Microscopy (1)
ARC-038	Apsalos	Gluing	Repairing	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1)

ARC-039	Apsalos	Application	Container Decoration	Tar	Birch Bark Tar	Animal Fat (Beeswax)	Chemical Analysis (1)
ARC-040	Arbon-Bleiche 3	Application	Architectural	Plaster	Unidentified Plaster	Animal Fat (Beeswax)	No Analysis (1; 2)
ARC-041	Arbon-Bleiche 3	Gluing	Hafting	Tar	Birch Bark Tar	Animal Fat (Beeswax)	Optical Microscopy (1)
ARC-042	Arbon-Bleiche 3	Gluing	Object Manufacture	Unidentified	Unidentified Adhesive	Animal Fat (Birch Bark Tar)	No Analysis (1)
ARC-043	Argissa Magoula	Unknown	Unknown	Plaster	Unidentified Plaster	Animal Fat (Beeswax)	No Analysis (1)
ARC-044	Aşaği Pinar	Application	Architectural	Plaster	Unidentified Plaster	Beeswax (Birch Bark Tar)	Physical Examination (1)
ARC-045	Asaviec 2	Gluing	Hafting	Unidentified	Unidentified Adhesive	Animal Fat (Pine Resin)	Optical Microscopy (1); Physical Examination (1)
ARC-046	Aşıklı Höyük	Application	Architectural	Plaster	Lime Plaster	Animal Fat (Birch Bark Tar)	Chemical Analysis (1; 2); Optical Microscopy (1; 2)
ARC-047	Atlit-Yam	Gluing	Hafting	Bitumen	Bitumen	N	No Analysis (1)
ARC-048	Aukštumala	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1)
ARC-049	Auriac	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1)
ARC-050	Avgi	Application	Architectural	Unidentified	Unidentified Plaster	N	No Analysis (1)

ARC-051	Azraq 18	Application	Object Decoration	Bitumen	Bitumen	N	Physical Examination (1)
ARC-052	Baaz Rockshelter	Application	Architectural	Plaster	Unidentified Plaster	N	Optical Microscopy (1); Physical Examination (2)
ARC-053	Baaz Rockshelter	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-054	Baaz Rockshelter	Unknown	Unknown	Plaster	Lime Plaster	N	Optical Microscopy (1); Physical Examination (2)
ARC-055	Bad Buchau-Bachwissen I	Chewing	Unknown	Tar	Birch Bark Tar	N	No Analysis (1)
ARC-056	Ba'ja	Application	Architectural	Plaster	Mud Plaster; Unidentified Plaster	Charcoal and Plaster Chunks (Mud Plaster)	Physical Examination (1; 2; 3)
ARC-057	Bâlgarčevo	Application	Architectural	Plaster	Unidentified Plaster	Vegetal Material (Unidentified Plaster)	Physical Examination (1)
ARC-058	Ballintaggart	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-059	Barmose I	Chewing	Medicinal/ Processing	Tar	Birch Bark Tar	N	Chemical Analysis (2); No Analysis (1)
ARC-060	Bastuloken	Unknown	Unknown	Resin	Cupressaceae Resin	N	Chemical Analysis (1)
ARC-061	Bazel-Sluis	Gluing	Hafting	Resin	Unidentified Resin	Charcoal (Unidentified Resin)	Optical Microscopy (1)

ARC-062	Beaurieux	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-063	Beidha	Application	Architectural	Plaster	Clay Plaster; Lime Plaster	Sand (Clay Plaster); Sand (Lime Plaster)	No Analysis (1); Physical Examination (2)
ARC-064	Beidha	Application	Sealing	Bitumen; Plaster	Bitumen; Lime Plaster	N	No Analysis (1); Physical Examination (2)
ARC-065	Beisamoun	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (2; 4); Optical Microscopy (3); Physical Examination (1)
ARC-066	Beisamoun	Application	Repairing	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-067	Beisamoun	Application	Object Decoration	Plaster	Clay Plaster; Lime Plaster	Ash, Calcite, Lime Plaster, Ochre and Silt (Clay Plaster)	Chemical Analysis (2); No Analysis (1; 3); Optical Microscopy (2)
ARC-068	Belitsi Magoula	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-069	Bellevue	Application	Architectural	Plaster	Clay Plaster	Sand (Clay Plaster); Sand and Unidentified Aggregate (Clay Plaster); Gravel and Sand (Clay Plaster); Sand and Vegetal Material (Clay Plaster); Gravel,	Optical Microscopy (1); Physical Examination (1)

						Sand and Vegetal Material (Clay Plaster)	
ARC-070	Bercy	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-071	Bestansur	Application	Architectural	Plaster	Lime Plaster; Unidentified Plaster	N	Chemical Analysis (2); No Analysis (1); Optical Microscopy (2)
ARC-072	Bestansur	Application	Object Decoration	Bitumen	Bitumen	N	Chemical Analysis (2); No Analysis (1); Optical Microscopy (2)
ARC-073	Bischoffsheim	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-074	Blagotin	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1; 2); Physical Examination (3)
ARC-075	Bökeberg III	Chewing	Medicinal/ Processing	Tar	Birch Bark Tar	N	Chemical Analysis (1); No Analysis (2)
ARC-076	Borđoš	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-077	Božina Peskara	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-078	Brunn am Gebirge	Unknown	Unknown	Beeswax; Tar	Beeswax; Birch Bark Tar	N	Chemical Analysis (1; 2)
ARC-079	Bucşani	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)

ARC-080	Burgan Hill	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-081	Byblos	Application	Architectural	Plaster	Lime Plaster	Limestone (Lime Plaster)	Chemical Analysis (1)
ARC-082	Byblos	Application	Unknown	Plaster	Lime Plaster	Calcite (Lime Plaster)	Chemical Analysis (1)
ARC-083	Bylany	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-084	Bylany	Application/ Unknown	Flavouring/ Sealing	Resin; Tar	Beech or Oak Tar; Birch Bark Tar; Pine Resin	N	Chemical Analysis (1; 2)
ARC-085	Bylany	Application	Sealing	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-086	Caochanan Ruadha	Gluing	Hafting	Resin	Unidentified Resin	N	Physical Examination (1)
ARC-087	Casa Montero	Gluing	Hafting	Unidentified	Unidentified Adhesive	Ochre (Unidentified Adhesive)	Optical Microscopy (1); Physical Examination (1)
ARC-088	Çatalhöyük	Application	Binder/ Object Decoration	Bitumen	Bitumen	Charcoal (Bitumen)	Physical Examination (1)
ARC-089	Çatalhöyük	Application	Architectural	Plaster	Lime Plaster; Mud Plaster;	Vegetal Material (Mud Plaster)	Chemical Analysis (1; 2; 3; 6; 7); No Analysis (5); Optical

					Unidentified Plaster		Microscopy (2; 3; 6); Physical Examination (4; 8)
ARC-090	Çatalhöyük	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (6)
ARC-091	Çatalhöyük	Processing/ Production	Production	Plaster	Lime Plaster	N	No Analysis (2)
ARC-092	Çatalhöyük	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-093	Çatalhöyük	Application	Object Decoration	Plaster	Gypsum Plaster	N	Chemical Analysis (1); Optical Microscopy (1); Physical Examination (2)
ARC-094	Catignano	Gluing	Hafting	Bitumen	Bitumen	N	Chemical Analysis (1; 2)
ARC-095	Çayönü Tepesi	Application	Architectural	Plaster	Lime Plaster	Pebbles (Lime Plaster)	Chemical Analysis (1); Optical Microscopy (1)
ARC-096	Çayönü Tepesi	Unknown	Unknown	Beeswax	Beeswax	Animal Fat (Beeswax)	Chemical Analysis (1)
ARC-097	Chageh Sefid	Application	Architectural	Bitumen	Bitumen	N	No Analysis (1)
ARC-098	Chageh Sefid	Application	Sealing/ Storage	Bitumen	Bitumen	N	Chemical Analysis (1; 2)
ARC-099	Chageh Sefid	Application	Sealing	Bitumen	Bitumen	N	Chemical Analysis (1)
ARC-100	Chageh Sefid	Manufacture	Container Manufacture	Plaster	Gypsum Plaster	N	Chemical Analysis (2); No Analysis (1)

ARC-101	Chalain	Application/ Unknown	Flavouring/ Medicinal/ Sealing	Beeswax	Beeswax	Animal Fat (Beeswax)	Chemical Analysis (1; 2; 3; 4)
ARC-102	Chalain	Gluing	Hafting	Bitumen; Tar; Unidentified	Birch Bark Tar; Bitumen; Unidentified Adhesive; Unidentified Tar	Pine Resin (Unidentified Tar)	Chemical Analysis (1; 2; 3; 4)
ARC-103	Cham-Eslen	Gluing	Hafting	Tar	Birch Bark Tar	Conifer Resin (Egg Glue)	Physical Examination (1)
ARC-104	Cham-Eslen	Gluing	Object Decoration	Tar	Birch Bark Tar	Dung Plaster (Unidentified Plaster)	Physical Examination (1)
ARC-105	Champ-Durand	Application	Architectural	Plaster	Clay Plaster	Sand (Clay Plaster); Sand and Ochre (Clay Plaster); Sand, Limestone and Quartz (Clay Plaster); Shell and Vegetal Material (Clay Plaster)	Optical Microscopy (1); Physical Examination (1)
ARC-106	Chassey-le-Camp	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)

ARC-107	Chełmiczki 10	Application	Container Decoration	Tar	Unidentified Tar	Sand (Unidentified Tar)	Chemical Analysis (1); Optical Microscopy (1)
ARC-108	Cheviot Quarry	Application	Sealing	Beeswax	Beeswax	Animal Fat or Plant Oils (Beeswax)	Chemical Analysis (1)
ARC-109	Chevroux	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-110	Chogha Mish	Application	Sealing	Bitumen	Bitumen	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-111	Clairvaux VII	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-112	Clairvaux VII	Gluing	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-113	Clairvaux VII	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-114	Clairvaux VII	Gluing	Repairing	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-115	Clairvaux VII	Unknown	Unknown	Tar	Birch Bark Tar	N	Chemical Analysis (2); No Analysis (1); Physical Examination (2)
ARC-116	Clairvaux VII	Gluing	Object Manufacture	Tar	Birch Bark Tar	N	Chemical Analysis (2); No Analysis (1); Physical Examination (2)
ARC-117	Clairvaux XIV	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-118	Clairvaux XIV	Gluing	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)

ARC-119	Clairvaux XIV	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-120	Clairvaux XIV	Gluing	Repairing	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1); Physical Examination (1)
ARC-121	Clairvaux XIV	Unknown	Sealing/ Storage	Beeswax	Beeswax	Animal Fat (Beeswax); Dairy Products (Beeswax)	Chemical Analysis (1; 2)
ARC-122	Clairvaux XIV	Unknown	Unknown	Tar	Birch Bark Tar	Beeswax (Birch Bark Tar)	Chemical Analysis (1); Physical Examination (1)
ARC-123	Clairvaux XIV	Unknown	Container Decoration/ Repairing	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-124	Clairvaux XIV	Gluing	Object Manufacture	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-125	Claish Farm	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-126	Clonava I	Gluing	Hafting	Resin	Unidentified Resin	N	Physical Examination (1)
ARC-127	Colle Cera	Gluing	Hafting	Bitumen	Bitumen	N	Chemical Analysis (1; 2)
ARC-128	Colmar	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-129	Concise-sous-Colachoz	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)

ARC-130	Corongiu	Application	Binder/ Object Decoration	Animal	Egg Glue	Conifer Resin (Egg Glue)	Chemical Analysis (1)
ARC-131	Cortaillod	Application	Container Decoration	Bitumen	Bitumen	N	No Analysis (1)
ARC-132	Csárdaszállás 8	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-133	Cueva de El Toro	Application	Sealing	Resin	Pine Resin	Animal Fat (Pine Resin)	Chemical Analysis (1)
ARC-134	Daktariškė 5	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)
ARC-135	Daktariškė 5	Unknown	Unknown	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1)
ARC-136	Daktariškė 5	Application	Object Decoration	Plaster; Resin	Clay Plaster; Pine Resin	Beeswax and Charcoal (Pine Resin)	Chemical Analysis (1); No Analysis (2); Optical Microscopy (1); Physical Examination (1)
ARC-137	Danilo Bitinj	Unknown	Unknown	Plaster	Clay Plaster	Animal Fat and Plant Oils (Conifer Resin)	Chemical Analysis (1)
ARC-138	Defensola A	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-139	Demirköy Höyük	Unknown	Unknown	Bitumen	Bitumen	N	Chemical Analysis (1)
ARC-140	Demirköy Höyük	Manufacture	Object Manufacture	Bitumen	Bitumen	Sand (Bitumen)	Chemical Analysis (1)

ARC-141	Devèze-Sud	Unknown	Unknown	Resin	Conifer Resin	Animal Fat and Plant Oils (Conifer Resin)	Chemical Analysis (1)
ARC-142	Dikili Tash	Application/ Burning	Fuel/ Hygienic/ Incense/ Medicinal/ Sealing	Resin	Cupressaceae Resin	Lignite (Cupressaceae Resin); Lignite, Animal Fat or Plant Oils (Cupressaceae Resin); Lignite, Animal Fat or Plant Oils and possible Beeswax (Cupressaceae Resin);	Chemical Analysis (1; 2)
ARC-143	Dikili Tash	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-144	Dikili Tash	Application	Sealing	Resin	Conifer Resin	N	Chemical Analysis (1)
ARC-145	Divostin	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-146	Dja'de-el-Mughara	Gluing	Hafting	Bitumen	Bitumen	N	Optical Microscopy (1); Physical Examination (1)
ARC-147	Dja'de-el-Mughara	Unknown	Unknown	Bitumen	Bitumen	N	Optical Microscopy (1); Physical Examination (1)

ARC-148	Dobroń	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-149	Dobroslavtsi	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-150	Dombate	Application	Binder/ Object Decoration	Plaster	Clay Plaster	N	No Analysis (1)
ARC-151	Domuztepe	Application	Sealing	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-152	Dorstone Hill	Application	Architectural	Plaster	Unidentified Plaster	Dung Plaster (Unidentified Plaster)	Physical Examination (1)
ARC-153	Dosariyah	Application	Architectural/ Sealing	Bitumen	Bitumen	N	Chemical Analysis (2); Physical Examination (1)
ARC-154	Dosariyah	Manufacture	Sealing	Bitumen	Bitumen	N	Chemical Analysis (2); Physical Examination (1)
ARC-155	Dosariyah	Unknown	Unknown	Bitumen	Bitumen	N	Chemical Analysis (2); Physical Examination (1)
ARC-156	Dosariyah	Manufacture	Container Manufacture	Bitumen	Bitumen	N	Chemical Analysis (2); Physical Examination (1)
ARC-157	Drakaina Cave	Application	Architectural	Plaster	Lime Plaster	Charcoal, Clay Plaster, Feldspar, Mica and Plaster Chunks (Lime Plaster)	Chemical Analysis (1); No Analysis (2); Optical Microscopy (1)

ARC-158	Dreniai	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)
ARC-159	Drenovac	Gluing	Repairing	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar); Animal Fat and Pine Resin (Birch Bark Tar)	Chemical Analysis (1)
ARC-160	Drenovac	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-161	Drenovac	Application	Sealing	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-162	Dubovo-Košno	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1)
ARC-163	Dudeştii Vechi	Unknown	Unknown	Plaster	Clay Plaster	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-164	Durrington Walls	Application	Architectural	Plaster	Chalk Plaster; Unidentified Plaster	N	No Analysis (1)
ARC-165	Durrington Walls	Unknown	Unknown	Beeswax	Beeswax	Dairy Products (Beeswax)	Chemical Analysis (1)
ARC-166	Duvensee	Gluing	Hafting	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-167	Duvensee	Chewing	Unknown	Tar	Birch Bark Tar	N	No Analysis (1)

ARC-168	Dværgebakke I	Chewing	Hygienic/ Medicinal	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-169	Dvoinaya Cave	Gluing	Hafting	Resin	Conifer Resin	Animal Fat, Calcite and Coal (Unidentified Animal Glue); Calcite and Clay Plaster (Conifer Resin, Fruit Gum and Unidentified Animal Glue); Calcite, Clay Plaster, possible Coal and possible Quartz (Conifer Resin, possible Fruit Gum and Unidentified Animal Glue)	Chemical Analysis (1); Optical Microscopy (1)
ARC-170	Ecsegfalva 23	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-171	Egemarke	Gluing	Repairing	Tar	Birch Bark Tar	N	Physical Examination (1)

ARC-172	Egolzwil 3	Gluing	Container Decoration	Tar	Birch Bark Tar	N	No Analysis (2); Optical Microscopy (1); Physical Examination (1)
ARC-173	Egolzwil 3	Gluing	Hafting	Plaster	Unidentified Adhesive	N	No Analysis (2); Optical Microscopy (1); Physical Examination (1)
ARC-174	Eireira	Application	Binder/ Object Decoration	Animal; Resin/Other	Algin; Egg Glue	N	Chemical Analysis (1)
ARC-175	el-Hemmeh	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1; 2; 3; 4)
ARC-176	el-Hemmeh	Application	Sealing	Plaster	Unidentified Plaster	N	Physical Examination (1; 2; 3)
ARC-177	el-Khirbe	Processing/ Production	Production	Plaster	Lime Plaster	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-178	el-Kum	Application	Architectural	Plaster	Clay Plaster; Unidentified Plaster	N	No Analysis (1)
ARC-179	Ensisheim	Unknown	Unknown	Beeswax	Beeswax	Animal Fat (Beeswax)	Chemical Analysis (1)
ARC-180	Ensisheim	Application	Object Decoration	Resin	Unidentified Resin	N	No Analysis (1)
ARC-181	Ergolding Fischergasse	Gluing	Hafting	Tar	Unidentified Tar	N	No Analysis (1)

ARC-182	Ergolding Fischergasse	Processing/ Production	Production	Tar	Unidentified Tar	N	No Analysis (1)
ARC-183	Ergolding Fischergasse	Gluing	Repairing	Tar	Birch Bark Tar; possible Pine Bark Tar	N	Chemical Analysis (1)
ARC-184	Ergolding Fischergasse	Unknown	Sealing/ Storage	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-185	Ergolding Fischergasse	Chewing	Unknown	Tar	Birch Bark Tar; possible Pine Bark Tar	N	Chemical Analysis (1)
ARC-186	Ergolding Fischergasse	Unknown	Unknown	Beeswax; Tar	Beeswax; Birch Bark Tar; Pine Bark Tar	N	Chemical Analysis (1; 3); No Analysis (2)
ARC-187	Ergolding Fischergasse	Application	Sealing	Tar	Birch Bark Tar; possible Pine Bark Tar	N	Chemical Analysis (1)
ARC-188	Eton Rowing Lake	Unknown	Unknown	Beeswax	Beeswax	Animal Fat (Beeswax); Dairy Products (Beeswax)	Chemical Analysis (1)
ARC-189	Foeni-Sălaş	Application	Architectural	Plaster	Clay Plaster	Sand (Clay Plaster); Sand and Silt (Clay Plaster); Sand, Silt and Vegetal Material (Clay	Chemical Analysis (1); Optical Microscopy (1); Physical Examination (2)

						Plaster); Shell (Clay Plaster); Silt (Clay Plaster); Vegetal Material (Clay Plaster)	
ARC-190	Font-Juvénal	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-191	Fornace Capuccini	Gluing	Hafting	Bitumen	Bitumen	N	Optical Microscopy (1)
ARC-192	Friedberg B3a Km 19	Gluing	Hafting	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-193	Friedberg B3a Km 19	Gluing	Repairing	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-194	Friedberg B3a Km 19	Application	Sealing	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-195	Friesack	Gluing	Hafting	Bitumen	possible Bitumen	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-196	Ftélia	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-197	Füzesabony-Gubakút	Application	Architectural	Plaster	Clay Plaster	N	Chemical Analysis (1); No Analysis (2); Optical Microscopy (1)
ARC-198	Ganj Dareh Tepe	Application	Architectural	Plaster	Mud Plaster	N	No Analysis (1)
ARC-199	Gazel	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)

ARC-200	Gesher	Gluing	Hafting	Plaster	Clay Plaster	Calcite, Ochre and Quartz (Clay Plaster)	Chemical Analysis (1); Optical Microscopy (1); Physical Examination (1)
ARC-201	Ghwair I	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-202	Gilgal I	Application	Architectural	Plaster	Clay Plaster; Mud Plaster	N	Optical Microscopy (1)
ARC-203	Gilgal I	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-204	Gilgal I	Unknown	Unknown	Bitumen	Bitumen	N	No Analysis (1)
ARC-205	Gilgal I	Application	Sealing	Bitumen	Bitumen	N	No Analysis (1; 2)
ARC-206	Gilgal I	Application	Object Decoration	Bitumen	Bitumen	N	No Analysis (1)
ARC-207	Gilgal II	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-208	Giribaldi	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-209	Giribaldi	Unknown	Unknown	Unidentified	Unidentified Adhesive	N	Chemical Analysis (1; 2)
ARC-210	Girmeler Cave	Application	Architectural	Plaster	Lime Plaster; Unidentified Plaster	N	Physical Examination (1)

ARC-211	Göbekli Tepe	Application	Architectural	Plaster	Loam Plaster; Mud Plaster	Charcoal (Loam Plaster)	No Analysis (1; 2)
ARC-212	Gorhambury	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-213	Gorjani-Kremenjača	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-214	Gorzsa	Application	Architectural	Plaster	Unidentified Plaster	Vegetal Material (Unidentified Plaster)	Chemical Analysis (1); Optical Microscopy (1)
ARC-215	Göytepe	Application	Container Decoration		Bitumen	N	Physical Examination (1; 2)
ARC-216	Göytepe	Application	Architectural	Plaster	Mud Plaster	N	No Analysis (1)
ARC-217	Göytepe	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1; 2)
ARC-218	Göytepe	Processing/ Production	Processing/ Storage	Bitumen	Bitumen	N	Physical Examination (1)
ARC-219	Göytepe	Unknown	Repairing/ Sealing	Bitumen	Bitumen	N	Physical Examination (1; 2)
ARC-220	Gradište	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-221	Grande Rivoire	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1; 2); Physical Examination (1)

ARC-222	Gribaša 4	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)
ARC-223	Grotta dei Cervi	Gluing	Repairing	Bitumen	Bitumen	N	Chemical Analysis (1)
ARC-224	Grotta dei Piccioni	Unknown	Unknown	Bitumen	Bitumen	N	Chemical Analysis (1)
ARC-225	Grube-Rosenhof	Unknown	Unknown	Beeswax; Unidentified	Beeswax; Unidentified Adhesive	N	Chemical Analysis (1)
ARC-226	Grumăzești	Application	Architectural	Plaster	Unidentified Plaster	Sand and Vegetal Material (Unidentified Plaster)	No Analysis (1); Physical Examination (2)
ARC-227	Gusir Höyük	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-228	H3	Application	Caulking	Bitumen	Bitumen	Barnacle Fragments, Clay Plaster, Sand and Shell (Bitumen); Barnacle Fragments, Sand, Shell and Vegetal Material (Bitumen); Sand,	Chemical Analysis (1); No Analysis (5; 6); Physical Examination (1; 2; 3; 4)

						Shell and Vegetal Material (Bitumen)	
ARC-229	H3	Manufacture	Sealing	Bitumen	Bitumen	N	Chemical Analysis (1); Physical Examination (1)
ARC-230	Hacı Elamxanlı Tepe	Gluing	Hafting	Bitumen	Bitumen	N	No Analysis (1)
ARC-231	Hacilar	Application	Architectural	Plaster	Clay Plaster; Mud Plaster; Lime Plaster	Unidentified Aggregate (Lime Plaster)	Chemical Analysis (1); Physical Examination (2)
ARC-232	Hagoshrim IV	Gluing	Hafting	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-233	Hajji Firuz Tepe	Application	Preservative/ Sealing	Resin	Pistacia Resin	N	Chemical Analysis (2); No Analysis (1)
ARC-234	Hama M	Application	Architectural	Plaster	Gypsum Plaster; Lime Plaster	N	Chemical Analysis (1)
ARC-235	Hama M	Application/ Processing/ Production	Production/ Sealing	Plaster	Lime Plaster	N	Chemical Analysis (1)
ARC-236	Hanaton	Application	Architectural	Plaster; Unidentified	Mud Plaster; Unidentified Adhesive	N	No Analysis (1)
ARC-237	Hanaton	Gluing	Hafting	Plaster; Unidentified	Mud Plaster; Unidentified Adhesive	N	No Analysis (1)

ARC-238	Hangest-sur-Somme	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Physical Examination (1)
ARC-239	Har Harif	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-240	Hauslabjoch	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (2); Physical Examination (1)
ARC-241	Hayonim	Processing/ Production	Production	Plaster	Lime Plaster	N	Chemical Analysis (2); No Analysis (3); Physical Examination (1)
ARC-242	Heilbronn-Klingenberg	Processing/ Production	Unknown	Plaster	Unidentified Plaster	Vegetal Material (Unidentified Plaster)	Physical Examination (1)
ARC-243	Henauhof-Nord II	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-244	Henauhof-Nord II	Processing/ Production	Production	Tar	Birch Bark Tar	N	No Analysis (1)
ARC-245	Hilazon Tachtit	Application	Architectural	Plaster	Mud Plaster	N	Chemical Analysis (2); No Analysis (3; 4); Optical Microscopy (1); Physical Examination (2)
ARC-246	Horákov	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-247	Hornstaad-Hörnle I	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-248	Hornstaad-Hörnle I	Chewing	Hygienic/ Medicinal/ Processing	Tar	Birch Bark Tar	N	Chemical Analysis (1; 2); Physical Examination (1)

ARC-249	Hornstaad-Hörnle I	Application/ Gluing	Repairing/ Sealing	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-250	Hornstaad-Hörnle I	Processing/ Production	Processing	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-251	Horvat Galil	Application	Architectural	Plaster	Clay Plaster; Lime Plaster	Chalk and Lime Plaster (Clay Plaster); Calcite and Soil (Lime Plaster)	Optical Microscopy (2); Physical Examination (1; 3)
ARC-252	Horvat Galil	Unknown	Unknown	Plaster	Lime Plaster	N	Optical Microscopy (1)
ARC-253	Horvat Galil	Manufacture	Container Manufacture	Plaster	Lime Plaster	Ash and Clay Plaster (Lime Plaster); Clay Plaster and Limestone (Lime Plaster)	Optical Microscopy (2); Physical Examination (1)
ARC-254	Hovland 3	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-255	Hrdlovka	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-256	Huddunge 230	Gluing/ Unknown	Hafting/ Unknown	Plaster	Unidentified Adhesive	N	Chemical Analysis (1); Physical Examination (1)
ARC-257	Huseby Klev	Application	Caulking	Tar	Birch Bark Tar	N	Chemical Analysis (2); Physical Examination (1)

ARC-258	Huseby Klev	Chewing	Hygienic/ Medicinal/ Processing	Tar	Birch Bark Tar	N	Chemical Analysis (1; 3); Physical Examination (2)
ARC-259	Huseby Klev	Gluing	Hafting	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-260	Huseby Klev	Processing/ Production	Processing	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-261	Huseby Klev	Application	Sealing	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-262	Ilindentsi	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-263	Inchture	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-264	Iraq ed-Dubb	Application	Architectural	Plaster	Mud Plaster	N	No Analysis (1)
ARC-265	Ispiluncas	Application	Binder/ Object Decoration	Animal	Egg Glue	N	Chemical Analysis (1)
ARC-266	Ivanovskoye 7	Gluing	Hafting	Resin	Conifer Resin	Beeswax and Charcoal (Conifer Resin)	No Analysis (1); Optical Microscopy (2; 3)
ARC-267	Jarmo	Gluing	Hafting	Bitumen	Bitumen	N	No Analysis (1; 2)
ARC-268	Jarmo	Application	Sealing	Bitumen	Bitumen	N	No Analysis (1)

ARC-269	Jaroměř	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-270	Jerf el-Ahmar	Gluing	Hafting	Bitumen	Bitumen	N	No Analysis (1)
ARC-271	Jericho	Application	Architectural	Plaster	Lime Plaster	Calcite and Quartz (Lime Plaster)	Chemical Analysis (1; 3; 4); No Analysis (2); Optical Microscopy (1)
ARC-272	Jericho	Application	Object Decoration	Bitumen; Plaster	Bitumen; Clay Plaster; Lime Plaster; Marl Plaster	Lime Plaster and Ochre (Clay Plaster); Lime Plaster (Marl Plaster); Sand (Marl Plaster)	Chemical Analysis (3; 2; 5); No Analysis (6); Optical Microscopy (2; 3; 4; 5); Physical Examination (1; 4; 7)
ARC-273	Jericho	Application	Object Manufacture	Plaster	Clay Plaster; Lime Plaster; Marl Plaster	Lime Plaster, Limestone and Quartz (Clay Plaster); Lime Plaster (Marl Plaster); Sand (Marl Plaster); Sandstone and Quartz (Lime Plaster)	Chemical Analysis (2); No Analysis (3); Physical Examination (1)
ARC-274	Jordløse Mose	Unknown	Unknown	Resin	Pine Resin	Animal Fat, Beeswax, Dairy	Chemical Analysis (1)

						Products and Plant Waxes (Pine Resin)	
ARC-275	Kääpa	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-276	Kalavasos-Tenta	Application	Architectural	Plaster	Clay Plaster; Gypsum Plaster; Lime Plaster; Mud Plaster	Vegetal Material (Clay Plaster); Calcite and Lime Plaster (Gypsum Plaster); Vegetal Material (Mud Plaster)	Chemical Analysis (1; 3); No Analysis (2); Optical Microscopy (1; 3)
ARC-277	Kalmaküla	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-278	Kanaljordan	Gluing	Hafting	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-279	Kaszás Domb	Unknown	Unknown	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-280	Katra I	Gluing	Hafting	Tar	Unidentified Tar	N	Optical Microscopy (1); Physical Examination (1)
ARC-281	Kauniinmetsänniitty 1	Chewing	Processing	Tar	Birch Bark Tar	N	No Analysis (1)
ARC-282	Kauniinmetsänniitty 1	Unknown	Unknown	Tar	Birch Bark Tar	N	No Analysis (1)

ARC-283	Kfar HaHoresh	Application	Architectural	Plaster	Lime Plaster	Chalk (Lime Plaster)	No Analysis (3); Optical Microscopy (1); Physical Examination (5; 2; 4)
ARC-284	Kfar HaHoresh	Processing/ Production	Production	Plaster	Lime Plaster	N	No Analysis (2); Optical Microscopy (1)
ARC-285	Kfar HaHoresh	Unknown	Unknown	Bitumen	Bitumen	N	Physical Examination (1)
ARC-286	Kfar HaHoresh	Application	Object Decoration	Plaster; Unidentified	Lime Plaster; Unidentified Adhesive	Ash (Lime Plaster)	Chemical Analysis (3); No Analysis (1; 2; 5); Physical Examination (3; 4)
ARC-287	Kharaysin	Application	Architectural	Plaster	Lime Plaster	N	No Analysis (1)
ARC-288	Khirokitia	Application	Architectural	Plaster	Clay Plaster; Mud Plaster	Calcite (Clay Plaster); Vegetal Material (Clay Plaster); Vegetal Material (Mud Plaster)	Chemical Analysis (1; 2); Optical Microscopy (1; 2)
ARC-289	Kierikin Sorakuoppa	Unknown	Unknown	Tar	Birch Bark Tar	N	No Analysis (1)
ARC-290	Kierkkisaari	Unknown	Unknown	Tar	Birch Bark Tar	N	No Analysis (1)
ARC-291	Kinbeachie	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)

ARC-292	Kobyłki	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-293	Kolín	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-294	Kolín	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-295	Kõnnu	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-296	Kõpu	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-297	Körtik Tepe	Application	Architectural	Plaster	Gypsum Plaster	N	Chemical Analysis (1); Optical Microscopy (1); Physical Examination (1)
ARC-298	Körtik Tepe	Application	Object Decoration	Plaster	Gypsum Plaster; Unidentified Plaster	Lime Plaster (Gypsum Plaster)	Chemical Analysis (1); No Analysis (2); Optical Microscopy (1); Physical Examination (1)
ARC-299	Kouvéléikès A and B	Unknown	Unknown	Beeswax	Beeswax	Unidentified Animal Glue (Lime Plaster)	Chemical Analysis (1)
ARC-300	Kowal 14	Unknown	Unknown	Plaster	Lime Plaster	Plant Oils (Pine Resin)	Chemical Analysis (1); Optical Microscopy (1); Physical Examination (1)

ARC-301	Kowal 14	Gluing	Object Manufacture	Plaster	Lime Plaster	Unidentified Animal Glue (Lime Plaster)	Chemical Analysis (1); Optical Microscopy (1); Physical Examination (1)
ARC-302	Kownacica	Application	Architectural	Plaster	Unidentified Plaster	Dairy Products (Beeswax)	No Analysis (1)
ARC-303	Kralice na Hané	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-304	Kretuonas 1C	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)
ARC-305	Krhov	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-306	Kroodi	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-307	Künzing-Unternberg	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-308	Kuuselankangas	Chewing	Unknown	Resin	Unidentified Resin	N	No Analysis (1)
ARC-309	La Capoulière	Application	Architectural	Plaster	Clay Plaster	N	Optical Microscopy (1); Physical Examination (1)
ARC-310	La Draga	Gluing	Hafting	Resin	Pine Resin	N	Optical Microscopy (1; 2); Physical Examination (1; 2)
ARC-311	La Hougue Bie	Burning	Incense	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-312	La Karelslé	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1)

ARC-313	La Molina	Application	Object Decoration	Resin	Pine Resin	N	Chemical Analysis (1; 2); Optical Microscopy (1; 2)
ARC-314	La Revilla del Campo	Unknown	Unknown	Plaster	Unidentified Plaster	Vegetal Material (Unidentified Plaster)	No Analysis (1)
ARC-315	La Rouvière	Application/ Gluing	Repairing/ Sealing	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-316	Lackford Heath	Unknown	Unknown	Tar	Birch Bark Tar	Clay Plaster and possible Animal Fat (Birch Bark Tar)	Chemical Analysis (1; 2); Optical Microscopy (2); Physical Examination (2)
ARC-317	Laigh Newton	Application	Architectural	Plaster	Clay Plaster	N	Physical Examination (1)
ARC-318	Laigh Newton	Unknown	Unknown	Plaster	Clay Plaster	N	Physical Examination (1)
ARC-319	Leira das Mamas	Application	Binder/ Object Decoration	Resin	Pine Resin	Plant Oils (Pine Resin)	Chemical Analysis (1)
ARC-320	Lenk-Schnidejoch	Gluing	Fletching	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-321	Lenk-Schnidejoch	Gluing	Hafting	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-322	Lepenski Vir	Application	Architectural	Plaster	Lime Plaster	Quartz (Lime Plaster)	Chemical Analysis (2); No Analysis (1)
ARC-323	Lerna	Gluing	Hafting	Resin	Unidentified Resin	N	Optical Microscopy (1)

ARC-324	Lešany	Gluing	Repairing	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-325	Lilla Loshults Mosse	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)
ARC-326	Limenaria	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-327	Liptovské Matiašovce-Bochníčky	Unknown	Unknown	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-328	Lommi	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-329	Lonche	Application	Medicinal	Beeswax	Beeswax	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-330	Lonche	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-331	Ludwinowo 7	Unknown	Unknown	Beeswax	Beeswax	Dairy Products (Beeswax)	Chemical Analysis (1)
ARC-332	Magareći Mlin	Unknown	Unknown	Beeswax	Beeswax	Dairy Products (Beeswax)	Chemical Analysis (1)
ARC-333	Mägura-Buduiasca	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-334	Makri	Application	Architectural	Plaster	Lime Plaster	Ash, Dung Plaster, Soil, Tufa and Unidentified	No Analysis (1); Optical Microscopy (2; 3); Physical Examination (2)

						Aggregate (Lime Plaster)	
ARC-335	Makriyalos 1	Application	Hygienic/ Preservative/ Sealing/ Storage	Beeswax	Beeswax	N	Chemical Analysis (1; 2; 3; 4)
ARC-336	Makriyalos 1	Gluing	Repairing	Tar	Birch Bark Tar; Pine Bark Tar	Animal Fat (Birch Bark Tar); Pine Resin (Birch Bark Tar)	Chemical Analysis (1; 2; 3; 4); Physical Examination (1)
ARC-337	Makriyalos 1	Unknown	Unknown	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1; 2; 3; 4); Physical Examination (1)
ARC-338	Makriyalos 1	Application	Sealing	Resin; Tar	Birch Bark Tar; Pine Bark Tar; Pine Resin	Animal Fat (Birch Bark Tar)	Chemical Analysis (1; 2; 3; 4); Physical Examination (1)
ARC-339	Mala Triglavca	Unknown	Unknown	Beeswax	possible Beeswax	Animal Fat (Birch Bark Tar)	Chemical Analysis (1)
ARC-340	Målevgård Mose	Unknown	Unknown	Resin	Pine Resin	Animal Fat, Aquatic Products and Dairy Products (Pine Resin)	Chemical Analysis (1)
ARC-341	Mali Alas	Unknown	Unknown	Plaster	Unidentified Plaster	N	No Analysis (1)

ARC-342	Mandra Antine	Application	Binder/ Object Decoration	Animal	Egg Glue	N	Chemical Analysis (1)
ARC-343	Mas d'Is	Application	Architectural	Plaster	Clay Plaster	N	Chemical Analysis (1)
ARC-344	Matesjski Brod	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-345	Meilen-Rorenhaab	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Physical Examination (1)
ARC-346	Melkoya	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-347	Melkoya	Unknown	Unknown	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-348	Mentesh Tepe	Application	Container Decoration	Bitumen	Bitumen	N	No Analysis (1)
ARC-349	Moghr el-Ahwal	Gluing	Architectural	Plaster	Lime Plaster	N	Optical Microscopy (1)
ARC-350	Moltzow	Application	Container Decoration	Plaster	Lime Plaster	N	No Analysis (2; 3); Physical Examination (1)
ARC-351	Moltzow	Gluing	Repairing	Unidentified	Unidentified Adhesive	N	No Analysis (2; 3); Physical Examination (1)
ARC-352	Mondeval de Sora	Gluing	Hafting	Resin	Conifer Resin	Propolis Resin (Conifer Resin)	Chemical Analysis (2); No Analysis (1); Optical Microscopy (2)
ARC-353	Mondeval de Sora	Unknown	Medicinal	Resin	Propolis Resin	N	Chemical Analysis (2); No Analysis (1); Optical Microscopy (2)

ARC-354	Mondsee	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-355	Moosseedorf	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-356	Moosseedorf	Gluing	Repairing	Bitumen	Bitumen	Ash (Bitumen)	Physical Examination (1)
ARC-357	Mosegarden	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1)
ARC-358	Motza	Application	Architectural	Plaster	Clay Plaster; Lime Plaster	N	No Analysis (2; 3); Physical Examination (1; 4)
ARC-359	Motza	Application	Sealing	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-360	Moverna Vas	Burning	Incense	Tar	Birch Bark Tar	Beeswax (Birch Bark Tar)	Chemical Analysis (1)
ARC-361	Moverna Vas	Processing/ Production	Processing/ Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-362	Moẓa	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-363	MR11	Manufacture	Container Manufacture	Plaster	Unidentified Plaster	N	No Analysis (1; 2)
ARC-364	Mrowino 3	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-365	Munhatta	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)

ARC-366	Mureybet	Gluing	Hafting	Bitumen	possible Bitumen	N	Optical Microscopy (1; 2; 3); Physical Examination (1)
ARC-367	Mursalevo-Deveboaz	Application	Architectural	Plaster	Clay Plaster	Dung Plaster and Urine (Clay Plaster)	Chemical Analysis (1); Optical Microscopy (1)
ARC-368	Nahal Ein Gev II	Application	Architectural	Plaster	Lime Plaster; Mud Plaster	Soil (Lime Plaster); Lime Plaster (Mud Plaster)	Chemical Analysis (1; 2); No Analysis (3); Optical Microscopy (1; 2)
ARC-369	Nahal Ein Gev II	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-370	Nahal Hemar	Gluing	Hafting	Animal	Bovine Collagen Glue	N	Chemical Analysis (1); Physical Examination (2)
ARC-371	Nahal Hemar	Application	Sealing	Animal	Animal Collagen Glue	Animal Blood (Animal Collagen Glue); Animal Blood and Sea Onion Latex (Animal Collagen Glue); Calcite (Lime Plaster)	Chemical Analysis (1; 3; 4); Optical Microscopy (1; 3); Physical Examination (2; 5)
ARC-372	Nahal Hemar	Application	Object Decoration	Animal; Unidentified	Bovine Collagen Glue; Unidentified Adhesive	Styrax Resin (Bovine Collagen Glue)	Chemical Analysis (4); No Analysis (1); Optical Microscopy (2); Physical Examination (2; 3; 5; 6)

ARC-373	Nahal Hemar	Gluing	Object Decoration	Unidentified	Unidentified Adhesive	N	Physical Examination (1)
ARC-374	Nahal Hemar	Manufacture	Object Manufacture	Plaster; Unidentified	Lime Plaster; Unidentified Adhesive	Calcite (Lime Plaster); Chalk and Vegetal Material (Lime Plaster); Clay Plaster and Vegetal Material (Lime Plaster); Limestone and Vegetal Material (Lime Plaster); Quartz and Vegetal Material (Lime Plaster)	Chemical Analysis (3); Optical Microscopy (2; 3); Physical Examination (1)
ARC-375	Nahal Yarmuth 38	Application	Architectural	Plaster	Lime Plaster	N	Physical Examination (1)
ARC-376	Nakonowo Stare 2	Gluing	Repairing	Tar	Unidentified Tar	Unidentified Aggregate (Unidentified Tar)	Chemical Analysis (1); Optical Microscopy (1)
ARC-377	Narva Joaorg	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-378	Nebelivka	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1)

ARC-379	Nemea 702	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-380	Nemrik 9	Application	Architectural	Plaster	Clay Plaster; Lime Plaster	N	No Analysis (1; 3); Physical Examination (2)
ARC-381	Ness of Brodgar	Application	Binder/ Container Decoration	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)
ARC-382	Neuenfeld 17	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-383	Newgrange	Unknown	Unknown	Plaster	Clay Plaster	N	Physical Examination (1)
ARC-384	Niederhummel	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-385	Niuet	Application	Architectural	Plaster	Clay Plaster	N	Chemical Analysis (1)
ARC-386	Nußdorf	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-387	Obšrūtai	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)
ARC-388	Orca da Lapa do Lobo	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1)
ARC-389	Ordea-Salca	Application	Architectural	Plaster	Clay plaster; Unidentified Plaster	N	No Analysis (1)

ARC-390	Orehøj Mose	Unknown	Unknown	Resin	Pine Resin	Beeswax and Plant Waxes (Pine Resin)	Chemical Analysis (1)
ARC-391	Ostorf-Tannenwerder I	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1; 2)
ARC-392	Otice-Rybníčky	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-393	Oulu Vepsänkangas	Chewing	Unknown	Unidentified	Unidentified Adhesive	N	Chemical Analysis (1)
ARC-394	Oulu Vepsänkangas	Application	Sealing	Resin	Unidentified Resin	N	Chemical Analysis (1)
ARC-395	Øvre Storvatnet	Chewing	Medicinal/ Processing	Tar	Birch Bark Tar	N	Chemical Analysis (1; 2)
ARC-396	Pakretuonė 4	Gluing	Hafting	Tar	Unidentified Tar	N	Optical Microscopy (1); Physical Examination (1)
ARC-397	Paliambela	Gluing	Repairing	Tar	Birch Bark Tar	N	Chemical Analysis (1; 2)
ARC-398	Paliambela	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-399	Palù di Livenza	Processing/ Production	Production	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-400	Palù di Livenza	Chewing	Unknown	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-401	Parkhaus Opéra	Gluing	Backing	Animal	Animal Collagen Glue	Animal Blood (Animal Collagen Glue)	Chemical Analysis (1)

ARC-402	Pas de la Charmate	Gluing	Hafting	Unidentified	Unidentified Adhesive	Animal Fat (Birch Bark Tar)	Optical Microscopy (1)
ARC-403	Pavlovac-Gumnište	Gluing	Repairing	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1)
ARC-404	Pestenacker	Gluing	Repairing	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1); Optical Microscopy (1)
ARC-405	Pestenacker	Unknown	Unknown	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1); Optical Microscopy (1)
ARC-406	Pfyn-Breitenloo	Gluing	Hafting	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-407	Piana di Curinga	Application	Architectural	Plaster	Clay Plaster	Obsidian Fragments (Clay Plaster); Pebbles (Clay Plaster); Vegetal Material (Clay Plaster)	Physical Examination (1)
ARC-408	Pijnacker	Gluing	Hafting	Tar	Unidentified Tar	N	No Analysis (1)
ARC-409	Plan da Mattun	Gluing	Hafting	Tar	Birch Bark Tar	N	No Analysis (1)
ARC-410	Poças de São Bento	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1)
ARC-411	Poças de São Bento	Unknown	Unknown	Plaster	Clay Plaster	N	No Analysis (1)

ARC-412	Pod Křídlem	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1)
ARC-413	Pod Zubem	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1; 2)
ARC-414	Podlesie	Unknown	Unknown	Tar	Birch Bark Tar	N	No Analysis (1)
ARC-415	Podrî l'Cortri	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-416	Podrî l'Cortri	Gluing	Repairing	Tar	Birch Bark Tar	Unidentified Aggregate (Birch Bark Tar)	Chemical Analysis (1; 2)
ARC-417	Podrî l'Cortri	Unknown	Unknown	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-418	Pokrovnik	Unknown	Unknown	Plaster	Clay Plaster	N	Chemical Analysis (1)
ARC-419	Polgar-10	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-420	Polgár-Bosnyákdomb	Unknown	Unknown	Plaster	Unidentified Plaster	N	Optical Microscopy (1)
ARC-421	Polgár-Csőszhalom	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (2); Physical Examination (1)
ARC-422	Polwica-Skrzypnik	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-423	Profitis Ilias Rizoupolis	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)

ARC-424	Promahonas	Application	Container Decoration	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1)
ARC-425	Ptaszkowice	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-426	Pulli	Gluing	Hafting	Tar	Birch Bark Tar	Animal Fat and Fir Resin (Birch Bark Tar)	Chemical Analysis (1); Physical Examination (1)
ARC-427	Pulli	Unknown	Unknown	Tar; Unidentified	Birch Bark Tar; Unidentified Adhesive	Animal Fat and Fir Resin (Birch Bark Tar)	Chemical Analysis (1); Physical Examination (1)
ARC-428	Qumran Cave 24	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Physical Examination (1)
ARC-429	R39	Gluing	Hafting	Resin	Unidentified Resin	N	Chemical Analysis (1)
ARC-430	RAÄ 1372	Chewing	Processing	Unidentified	Unidentified Adhesive	N	Physical Examination (1)
ARC-431	Rääkkylä Pörrinmökki	Gluing	Repairing	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-432	Rääkkylä Pörrinmökki	Chewing	Unknown	Resin	Unidentified Resin	N	No Analysis (1)
ARC-433	Rakushechny Yar	Unknown	Unknown	Resin	Conifer Resin	N	Chemical Analysis (1)
ARC-434	Rekem	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1; 2)

ARC-435	Rheinhausen	Gluing/ Processing/ Production	Object Manufacture/ Processing	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-436	Riigiküla IV	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-437	Ringsjöholm	Chewing	Unknown	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-438	Riparo Gaban	Gluing	Hafting	Bitumen	Bitumen	Beeswax (Bitumen)	Chemical Analysis (1); Optical Microscopy (1)
ARC-439	Riparo Gaban	Gluing	Hafting	Bitumen	Bitumen	Beeswax (Bitumen)	Chemical Analysis (1); Optical Microscopy (1)
ARC-440	Ripatetta	Gluing	Hafting	Bitumen	Bitumen	N	Chemical Analysis (1)
ARC-441	Risby Warren	Unknown	Unknown	Plaster	Clay Plaster	Vegetal Material (Clay Plaster)	No Analysis (1)
ARC-442	Rockanje	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	No Analysis (1)
ARC-443	Rönneholms Mosse	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1); No Analysis (2; 3); Physical Examination (1)
ARC-444	Rosheim	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-445	Rosheim	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-446	Rovantsi	Application	Container Decoration	Tar	Unidentified Tar	N	Physical Examination (1)

ARC-447	Rożniaty 2	Application	Sealing	Tar	Unidentified Tar	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-448	Rudna Wielka 5	Application	Container Decoration	Tar	Birch Bark Tar	Unidentified Aggregate (Birch Bark Tar)	Chemical Analysis (1); Optical Microscopy (1)
ARC-449	Rudna Wielka 5	Processing/ Production	Production	Tar	Birch Bark Tar	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-450	Ruhnu II	Processing/ Production	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-451	Runnymede Bridge	Processing/ Production	Flavouring	Beeswax	Beeswax	Unidentified Resin (Beeswax)	Chemical Analysis (1); Optical Microscopy (1)
ARC-452	Runnymede Bridge	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1; 2)
ARC-453	Ryńsk 42	Application	Container Decoration	Tar	Unidentified Tar	Sand (Unidentified Tar)	Chemical Analysis (1); Optical Microscopy (1)
ARC-454	Saarijärvi Summassaari Uimaranta	Unknown	Unknown	Tar	Birch Bark Tar	N	No Analysis (1)
ARC-455	Saflulim	Gluing	Hafting	Plaster	Lime Plaster	N	Optical Microscopy (1); Physical Examination (1)
ARC-456	Saflulim	Gluing	Hafting	Unidentified	Unidentified Adhesive	Ash (Unidentified Adhesive)	Optical Microscopy (1); Physical Examination (1)
ARC-457	Salibiya IX	Gluing	Hafting	Bitumen	Bitumen	N	No Analysis (1; 2)

ARC-458	San Martino	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-459	San Rocco	Unknown	Unknown	Plaster	Clay Plaster	Vegetal Material (Clay Plaster)	Chemical Analysis (1); Optical Microscopy (1)
ARC-460	San Sebastiano di Perti	Application	Architectural	Plaster	Clay Plaster	Quartz, Mica and Vegetal Material (Clay Plaster)	Optical Microscopy (1)
ARC-461	Sant'Andrea Priu	Application	Binder/ Object Decoration	Animal	Egg Glue	N	Chemical Analysis (1)
ARC-462	Šarišské Michaľany	Application	Container Decoration	Tar	Unidentified Tar	Sand (Unidentified Tar)	Chemical Analysis (1); Optical Microscopy (1)
ARC-463	Sarnevo	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-464	Sarnevo	Application	Sealing	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-465	Sarnowo	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1)
ARC-466	Schipluiden	Chewing	Medicinal/ Processing	Tar	Birch Bark Tar	Beeswax and Animal Fat or Plant Oils (Birch Bark Tar)	Chemical Analysis (2); No Analysis (1)
ARC-467	Schipluiden	Gluing	Hafting	Tar	Birch Bark Tar	N	Optical Microscopy (1); Physical Examination (1)

ARC-468	Segebro	Chewing	Medicinal/ Processing	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-469	Sha'ar HaGolan	Manufacture	Object Manufacture	Plaster	Mud Plaster	N	Optical Microscopy (1)
ARC-470	Shanidar	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-471	Shanidar	Gluing	Hafting	Bitumen	Bitumen	N	No Analysis (1; 2)
ARC-472	Shaqarat Mazyad	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-473	Sheikh Ali	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-474	Shir	Application	Architectural	Plaster	Lime Plaster	N	Physical Examination (1)
ARC-475	Shir	Application	Sealing	Plaster	Lime Plaster	N	Physical Examination (1)
ARC-476	Shir	Unknown	Unknown	Plaster	Unidentified Plaster	N	Physical Examination (1; 2)
ARC-477	Shkârat Msaied	Application	Architectural	Plaster	Lime Plaster	N	Physical Examination (1)
ARC-478	Sierentz	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-479	Siniarzewo 1	Application	Sealing	Tar	Unidentified Tar	Unidentified Aggregate (Unidentified Tar)	Chemical Analysis (1); Optical Microscopy (1)

ARC-480	Slatinky	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-481	Slatinky	Gluing	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-482	Şoimuš - La Avicola	Unknown	Unknown	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-483	Sorisdale	Gluing	Hafting	Adhesive	Unidentified Adhesive	N	No Analysis (1)
ARC-484	Spiginas Grave 1	Gluing	Hafting	Tar	Unidentified Tar	N	Optical Microscopy (1); Physical Examination (1)
ARC-485	St. Aubin-Tivoli/Port-Conty	Application	Container Decoration	Tar	Birch Bark Tar	N	No Analysis (1)
ARC-486	St. Aubin-Tivoli/Port-Conty	Gluing	Hafting	Bitumen	Bitumen	N	No Analysis (1)
ARC-487	St. Aubin-Tivoli/Port-Conty	Gluing	Object Manufacture	Bitumen	Bitumen	N	No Analysis (1)
ARC-488	Stanovoye 4	Gluing	Hafting	Resin	Conifer Resin	Beeswax and Charcoal (Conifer Resin)	Optical Microscopy (1; 2)
ARC-489	Star Carr	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1; 2); Optical Microscopy (1; 2); Physical Examination (2; 3; 4)
ARC-490	Star Carr	Processing/ Production	Processing	Unidentified	Unidentified Adhesive	N	Physical Examination (1)

ARC-491	Star Carr	Processing/ Production	Storage	Tar	Birch Bark Tar	Beeswax and Clay Plaster (Birch Bark Tar)	Chemical Analysis (1; 2); Optical Microscopy (1; 2); Physical Examination (2; 3; 4)
ARC-492	Star Carr	Processing/ Production	Unknown	Resin	Pine Resin	Charcoal and Unidentified Aggregate (Pine Resin)	Chemical Analysis (1)
ARC-493	Starčevo	Application/ Unknown	Flavouring/ Sealing	Beeswax	Beeswax	Animal Fat (Beeswax)	Chemical Analysis (1; 2)
ARC-494	Starčevo	Gluing	Repairing	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-495	Stavroupoli	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1; 2)
ARC-496	Stavroupoli	Gluing	Repairing	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1; 2)
ARC-497	Stavroupoli	Unknown	Unknown	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-498	Stavroupoli	Application	Sealing	Tar	Birch Bark Tar	N	Chemical Analysis (1; 2)
ARC-499	Storbreen	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Physical Examination (1)
ARC-500	Store Brokhøj	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1; 2)
ARC-501	Stránska skála	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)

ARC-502	Su Littu	Application	Binder/ Object Decoration	Animal	Egg Glue	N	Chemical Analysis (1)
ARC-503	Suplacu de Barcau	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-504	Sutz-Lattrigen Aussen	Gluing	Hafting	Tar	Birch Bark Tar	N	Optical Microscopy (1)
ARC-505	Šventoji 1	Unknown	Unknown	Tar	Birch Bark Tar	Animal Fat (Birch Bark Tar)	Chemical Analysis (1)
ARC-506	Šventoji 3	Application	Object Decoration	Resin	Unidentified Resin	N	Chemical Analysis (1); Optical Microscopy (1); Physical Examination (1)
ARC-507	Šventoji 3	Gluing	Object Decoration	Tar	Unidentified Tar	N	Optical Microscopy (1)
ARC-508	Šventoji 4	Application	Sealing/ Storage	Beeswax; Unidentified	Beeswax; Unidentified Adhesive	N	Chemical Analysis (1)
ARC-509	Šventoji 6	Application	Object Decoration	Resin	Unidentified Resin	N	Optical Microscopy (1)
ARC-510	Sweet Track F	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (2)
ARC-511	Swifterbant S3	Unknown	Unknown	Beeswax	Beeswax	Animal Fat or Plant Oils (Beeswax)	Chemical Analysis (1); Optical Microscopy (1)
ARC-512	Syltholm	Chewing	Medicinal/ Processing	Tar	Birch Bark Tar	N	Chemical Analysis (1)

ARC-513	Szakmár–Kisülés	Unknown	Unknown	Plaster	Unidentified Plaster	Vegetal Material (Unidentified Plaster)	Optical Microscopy (1)
ARC-514	Szeghalom-Kovácshalom	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1; 2)
ARC-515	Tabaqat al-Buma	Gluing	Hafting	Plaster	Lime Plaster	N	Physical Examination (1)
ARC-516	Tappeh Sang-e Chakhmaq	Application	Architectural	Plaster	Gypsum Plaster	N	No Analysis (1)
ARC-517	Tappeh Sang-e Chakhmaq	Gluing	Hafting	Bitumen	Bitumen	N	Optical Microscopy (1); Physical Examination (1)
ARC-518	Täuffelen	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-519	Tel Dan	Manufacture	Container Manufacture	Plaster	Lime Plaster	Clay Plaster and Limestone (Lime Plaster)	Optical Microscopy (1)
ARC-520	Tel Teo	Manufacture	Container Manufacture	Plaster	Lime Plaster	N	Optical Microscopy (1)
ARC-521	Tel Teo	Application	Architectural	Plaster	Mud Plaster	Calcite, Lime Plaster and Vegetal Material (Mud Plaster)	Optical Microscopy (1)
ARC-522	Tell Abu as-Sawwan	Application	Architectural	Plaster	Lime Plaster	Clay Plaster and Gravel (Lime Plaster); Gravel and	Physical Examination (1)

ARC-523	Tell Abu as-Sawwan	Gluing	Architectural	Plaster	Mud Plaster	Mud Plaster (Lime Plaster) Gravel, Pebbles and Plaster Chunks (Mud Plaster)	Physical Examination (1)
ARC-524	Tell al-Raqai	Application	Architectural	Plaster	Lime Plaster	N	Chemical Analysis (1)
ARC-525	Tell Assouad	Gluing	Hafting	Bitumen; Unidentified	Bitumen; Unidentified Adhesive	N	Physical Examination (1; 2)
ARC-526	Tell Aswad	Unknown	Unknown	Plaster	Unidentified Plaster	N	No Analysis (1; 2)
ARC-527	Tell Bouqras	Manufacture	Container Manufacture	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-528	Tell Bouqras	Application	Architectural	Plaster	Gypsum Plaster; Mud Plaster; Unidentified Plaster	N	No Analysis (2); Physical Examination (1)
ARC-529	Tell Bouqras	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-530	Tell Damishliyya	Application	Unknown	Plaster	Gypsum Plaster	N	Chemical Analysis (1)
ARC-531	Tell el'Far'ah	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)

ARC-532	Tell el'Oueili	Unknown	Unknown	Bitumen	Bitumen	N	Chemical Analysis (1)
ARC-533	Tell Feyda	Gluing	Hafting	Bitumen	Bitumen	N	Optical Microscopy (1); Physical Examination (2)
ARC-534	Tell Gudeda	Application	Architectural	Bitumen; Plaster	Bitumen; Gypsum Plaster	N	No Analysis (1)
ARC-535	Tell Hadidi	Gluing	Hafting	Plaster	Gypsum Plaster	N	Optical Microscopy (1)
ARC-536	Tell Halula	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-537	Tell Halula	Gluing	Hafting	Bitumen; Plaster	Bitumen; Lime Plaster	N	Physical Examination (1; 2)
ARC-538	Tell Halula	Application	Sealing	Bitumen	Bitumen	N	No Analysis (1; 2)
ARC-539	Tell Kashkashok I	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-540	Tell Kosak Shamali	Application	Caulking	Bitumen	Bitumen	Sand or Quartz and Vegetal Material (Bitumen)	Chemical Analysis (1; 2); Physical Examination (2)
ARC-541	Tell Kosak Shamali	Unknown	Unknown	Bitumen	Bitumen	N	Chemical Analysis (1; 2); Physical Examination (2)
ARC-542	Tell Labweh	Manufacture	Container Manufacture	Plaster	Unidentified Plaster	N	No Analysis (1)

ARC-543	Tell Labweh	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-544	Tell Maghzaliyah	Manufacture	Container Manufacture	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-545	Tell Maghzaliyah	Application	Architectural	Plaster	Gypsum Plaster; Mud Plaster	N	Physical Examination (1)
ARC-546	Tell Maghzaliyah	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-547	Tell Maghzaliyah	Application	Sealing	Plaster	Gypsum Plaster	N	Physical Examination (1)
ARC-548	Tell Maghzaliyah	Application	Sealing	Bitumen; Plaster	Bitumen; Gypsum Plaster	N	Physical Examination (1)
ARC-549	Tell Mashnaqa	Gluing	Hafting	Bitumen	Bitumen	N	No Analysis (1)
ARC-550	Tell Mounbatah	Manufacture	Container Manufacture	Plaster	Gypsum Plaster	N	Chemical Analysis (1)
ARC-551	Tell Mounbatah	Application	Sealing	Plaster	Clay Plaster	N	Chemical Analysis (1)
ARC-552	Tell Qarassa	Application	Architectural	Plaster	Clay Plaster	N	Optical Microscopy (1)
ARC-553	Tell Rakan I	Unknown	Unknown	Resin	Unidentified Resin	N	Physical Examination (1)

ARC-554	Tell Ramad	Manufacture	Container Manufacture	Plaster	Lime Plaster	Calcite and Gypsum Plaster (Lime Plaster); Charcoal, Limestone, Quartz and Vegetal Material (Lime Plaster); Limestone and Vegetal Material (Lime Plaster); Vegetal Material (Lime Plaster)	Chemical Analysis (1; 3); No Analysis (2); Optical Microscopy (3)
ARC-555	Tell Ramad	Application	Object Decoration	Plaster	Unidentified Plaster	N	No Analysis (1; 2)
ARC-556	Tell Ramad	Application	Architectural	Plaster	Lime Plaster	N	Chemical Analysis (2); No Analysis (1); Optical Microscopy (2)
ARC-557	Tell Sabi Abyad I	Application	Container Decoration	Bitumen	Bitumen	N	Chemical Analysis (1); Physical Examination (1)
ARC-558	Tell Sabi Abyad I	Application	Architectural	Plaster	Gypsum Plaster; Lime Plaster; Mud Plaster; Unidentified Plaster	Calcite (Gypsum Plaster); Calcite and Quartz (Gypsum Plaster); Quartz (Lime Plaster)	Chemical Analysis (1; 2); No Analysis (3)

ARC-559	Tell Sabi Abyad I	Gluing	Hafting	Bitumen	Bitumen	N	Optical Microscopy (1)
ARC-560	Tell Sabi Abyad I	Application	Sealing	Plaster	Clay Plaster; Gypsum Plaster	N	Chemical Analysis (1; 3); Physical Examination (1; 2)
ARC-561	Tell Sabi Abyad II	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-562	Tell Sabi Abyad II	Application	Sealing	Bitumen	Bitumen	N	Physical Examination (1)
ARC-563	Tell Samovodene	Application	Container Decoration	Plaster	Lime Plaster	Quartz (Lime Plaster)	Chemical Analysis (1); Optical Microscopy (1)
ARC-564	Tell Samovodene	Application	Architectural	Plaster	Lime Plaster	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-565	Tell Samovodene	Processing/ Production	Processing	Plaster	Lime Plaster	N	Chemical Analysis (1)
ARC-566	Tell Seker al-Aheimar	Application	Object Decoration	Plaster	Mud Plaster	N	Physical Examination (1)
ARC-567	Tell Seker al-Aheimar	Application	Architectural	Plaster	Gypsum Plaster	N	Optical Microscopy (1; 2)
ARC-568	Tell Seker al-Aheimar	Application	Sealing	Plaster	Gypsum Plaster	N	Optical Microscopy (1; 2)
ARC-569	Tell Yosef	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-570	Tell-e Atashi	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Physical Examination (1)

ARC-571	Telul eth-Thalathat	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Physical Examination (1)
ARC-572	Tepe Khaleseh	Application	Architectural	Plaster	Mud Plaster	Vegetal Material (Mud Plaster)	No Analysis (1)
ARC-573	Tepe Tula'i	Unknown	Unknown	Bitumen	Bitumen	N	Chemical Analysis (1; 2)
ARC-574	Têšetice-Kyjovice	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-575	Têšetice-Kyjovice	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-576	Têšetice-Kyjovice	Unknown	Unknown	Tar	Birch Bark Tar	N	Chemical Analysis (1); Physical Examination (1)
ARC-577	Thatcham III	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Chemical Analysis (1); No Analysis (2); Optical Microscopy (1); Physical Examination (1)
ARC-578	Thatcham III	Unknown	Unknown	Unidentified	Unidentified Adhesive	N	Chemical Analysis (1); No Analysis (2); Optical Microscopy (1); Physical Examination (1)
ARC-579	Théopetra	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-580	Tiefbrunn	Application	Container Decoration	Tar	Birch Bark Tar	N	Physical Examination (1)
ARC-581	Tiszaszőlős-Domaháza	Application	Architectural	Plaster	Clay Plaster	N	Chemical Analysis (2); No Analysis (1); Optical Microscopy (2)

ARC-582	Tominy 6	Gluing	Repairing	Tar	Unidentified Tar	Unidentified Aggregate (Unidentified Tar)	Chemical Analysis (1); Optical Microscopy (1)
ARC-583	Toptepe	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1)
ARC-584	Toptepe	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-585	Tor Hamar	Gluing	Hafting	Unidentified	Unidentified Adhesive	Ochre (Unidentified Adhesive)	Optical Microscopy (1)
ARC-586	Toumba Kremastis Koiladas	Application	Sealing	Tar	Pine Bark Tar	Animal Fat (Pine Bark Tar)	Chemical Analysis (1)
ARC-587	Tsirmiris	Gluing	Hafting	Resin	Unidentified Resin	Animal Fat (Beeswax)	Chemical Analysis (1); Optical Microscopy (1)
ARC-588	Uğurlu	Application	Architectural	Plaster	Clay Plaster; Lime Plaster; Mud Plaster	Animal Fat (Birch Wood Tar)	No Analysis (1)
ARC-589	Uivar	Application	Architectural	Plaster	Unidentified Plaster	Animal Fat (Birch Wood Tar)	No Analysis (1)
ARC-590	Ullafelsen	Gluing	Hafting	Tar	Birch Bark Tar	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-591	Ulucak Höyük	Application	Architectural	Plaster	Lime Plaster; Mud Plaster; Unidentified Plaster	N	Chemical Analysis (1); No Analysis (2; 3); Physical Examination (1)

ARC-592	Vaikantonys	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1); Physical Examination (1)
ARC-593	Vassilara Rachi	Unknown	Unknown	Beeswax	Beeswax	N	Chemical Analysis (1)
ARC-594	Vchynice	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-595	Vedrovice	Application	Container Decoration	Tar	Birch Bark Tar	N	Chemical Analysis (1)
ARC-596	Vésztő-Bikeri	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1; 2; 3)
ARC-597	Vihasoo III	Unknown	Unknown	Resin	Pine Resin	N	Chemical Analysis (1)
ARC-598	Vinča-Belo Brdo	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1; 2)
ARC-599	Vinča-Belo Brdo	Gluing	Hafting	Plaster; Resin	Unidentified Plaster; Unidentified Resin	N	Optical Microscopy (1)
ARC-600	Vinelz	Gluing	Hafting	Unidentified	Unidentified Adhesive	N	Physical Examination (1)
ARC-601	Virgen de Siete Iglesias	Unknown	Unknown	Unidentified	Unidentified Adhesive	N	Optical Microscopy (1)
ARC-602	Vlasac	Gluing	Object Manufacture	Unidentified	Unidentified Adhesive	Ochre (Unidentified Adhesive)	Chemical Analysis (1); Optical Microscopy (1)

ARC-603	Vrbjanska Čuka	Application	Architectural	Plaster	Unidentified Plaster	Vegetal Material (Unidentified Plaster)	No Analysis (1)
ARC-604	Wadi al-Qattafi	Application	Architectural	Plaster	Gypsum Plaster	Charcoal (Gypsum Plaster)	Physical Examination (1)
ARC-605	Wadi Murabba'at	Gluing	Object Manufacture	Bitumen	Bitumen	N	Optical Microscopy (1); Physical Examination (1)
ARC-606	Wadi Shu'eib	Application	Architectural	Plaster	Unidentified Plaster	N	Physical Examination (1)
ARC-607	Wadi Shu'eib	Manufacture	Object Manufacture	Bitumen; Plaster	Bitumen; Unidentified Plaster	N	Physical Examination (1; 2)
ARC-608	Wangen-Hinterhorn	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-609	Wetzikon-Robenhausen	Manufacture	Container Manufacture	Bitumen	Bitumen	N	Physical Examination (1)
ARC-610	Wetzikon-Robenhausen	Gluing	Hafting	Bitumen	Bitumen	N	Physical Examination (1)
ARC-611	WF16	Application	Architectural	Plaster	Mud Plaster	N	No Analysis (1; 4; 5); Physical Examination (2; 3)
ARC-612	Wisad Pools	Application	Architectural	Plaster	Gypsum Plaster	N	No Analysis (1)
ARC-613	Wolica Nowa 1	Unknown	Unknown	Beeswax	Beeswax	Animal Fat (Beeswax)	Chemical Analysis (1)

ARC-614	Yabalkovo	Application	Architectural	Plaster	Clay Plaster; Unidentified Plaster	N	No Analysis (1; 2)
ARC-615	Yarim Tepe I	Application	Architectural	Plaster	Clay Plaster; Gypsum Plaster	Gypsum Plaster and Vegetal Material (Clay Plaster); Vegetal Material (Gypsum Plaster)	Physical Examination (1; 2)
ARC-616	Yarim Tepe II	Application	Architectural	Plaster	Clay Plaster; Unidentified Plaster	N	Physical Examination (1; 2; 3)
ARC-617	Yarim Tepe II	Gluing	Hafting	Bitumen	Bitumen	N	No Analysis (1)
ARC-618	Yiftahel	Manufacture	Container Manufacture	Plaster	Clay Plaster; Lime Plaster	Chalk (Clay Plaster); Anhydrite, Chalk and Clay Plaster (Lime Plaster)	Optical Microscopy (1)
ARC-619	Yiftahel	Application	Object Decoration	Plaster	Lime Plaster	N	Optical Microscopy (1); Physical Examination (2; 3)
ARC-620	Yiftahel	Application	Architectural	Plaster	Lime Plaster; Mud Plaster	Ash, Plaster Chunks and Unidentified	Chemical Analysis (2; 7; 8); No Analysis (9; 10); Optical Microscopy (2; 4; 5; 6); Physical Examination (3; 7)

						Aggregate (Lime Plaster)	
ARC-621	Yiftahel	Gluing	Hafting	Bitumen; Unidentified	Bitumen; Unidentified Adhesive	N	No Analysis (1)
ARC-622	Yiftahel	Unknown	Unknown	Plaster	Lime Plaster	Vegetal Material (Lime Plaster)	Optical Microscopy (1)
ARC-623	Zahrat adh-Dhra‘ 2	Application	Architectural	Plaster	Lime Plaster; Unidentified Plaster	N	Physical Examination (1)
ARC-624	Zalaszentbalázs-Szölöhegyi	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1)
ARC-625	Zambujeiro	Application/ Gluing/ Unknown	Flavouring/ Repairing/ Sealing	Resin	Pine Resin	N	Chemical Analysis (1); Optical Microscopy (1)
ARC-626	Zamostje 2	Unknown	Unknown	Resin	Unidentified Resin	N	Chemical Analysis (1)
ARC-627	Zduńska Wola-Nowe Miasto	Application	Architectural	Plaster	Unidentified Plaster	N	No Analysis (1)
ARC-628	Zgornje Radvanje	Application	Architectural	Plaster	Clay Plaster	N	No Analysis (1)
ARC-629	Zsadány-Püski-Hügel	Application	Container Decoration	Bitumen	Bitumen	N	Physical Examination (1)

ARC-630	Żuławka 13	Chewing	Medicinal	Tar	Birch Bark Tar; Birch Wood Tar	Animal Fat (Birch Wood Tar)	Chemical Analysis (1); Optical Microscopy (1)
ARC-631	Żuławka 13	Gluing	Repairing	Tar	Birch Bark Tar; Birch Wood Tar	Animal Fat (Birch Wood Tar)	Chemical Analysis (1); Optical Microscopy (1)

Table 11. Adhesive classes, uses, additives and analytical techniques.

A2: Tabulated Database Results

	Region and Period								
	Europe			Near East			Total		
	Mesolithic	Neolithic	Total	Late Epipaleolithic	Neolithic	Total	LE/ Mesolithic	Neolithic	Total
Total Sites	57	253	308	11	114	125	68	367	433
Analytical Techniques									
No Use									
Chemical Analysis	25	134	157	4	37	41	29	171	198
Optical Microscopy	30	55	83	7	32	39	37	87	122
Physical Examination	26	59	84	7	57	64	33	116	148
No Analysis	15	82	97	5	62	67	20	144	164
% Use									
Chemical Analysis	43.9	53	51	36.4	32.5	32.8	42.6	46.6	45.7
Optical Microscopy	52.6	21.7	26.9	63.6	28.1	31.2	54.4	23.7	28.2
Physical Examination	45.6	23.3	27.3	63.6	50	51.2	48.5	31.6	34.2
No Analysis	26.3	32.4	31.5	45.5	54.4	53.6	29.4	39.2	37.9

Table 12. Sites providing evidence of adhesives, divided by region, period and methodology employed.

	Region and Period								
	Europe			Near East			Total		
Adhesive Class	Mesolithic	Neolithic	Total	Late Epipaleolithic	Neolithic	Total	LE/ Mesolithic	Neolithic	Total
Total Sites	57	253	308	11	114	125	68	367	433
No Classes									
Plasters	4	91	95	8	86	94	12	177	189
Tars	23	75	98				23	75	98
Bitumen	2	18	19	4	43	47	6	61	66
Resins/Others	12	37	49	1	3	4	13	40	53
Beeswax	6	42	47		3	3	6	45	50
Animal Glues	1	8	9		1	1	1	9	10
Unidentified	26	23	49	3	10	13	29	33	62
	74	**294**	**366**	**16**	**146**	**162**	**90**	**440**	**528**
% Classes									
Plasters	5.4	31	26	50	58.9	58	13.3	40.2	35.8
Tars	31.1	25.5	26.8				25.6	17	18.6
Bitumen	2.7	6.1	5.2	25	29.5	29	6.7	13.9	12.5
Resins/Others	16.2	12.6	13.4	6.3	2.1	2.5	14.4	9.1	10
Beeswax	8.1	14.3	12.8		2.1	1.9	6.7	10.2	9.5
Animal Glues	1.4	2.7	2.5		0.7	0.6	1.1	2	1.9
Unidentified	35.1	7.8	13.4	18.8	6.8	8	32.2	7.5	11.7
	100	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

% Sites									
Plasters	7	36	30.8	72.7	75.4	75.2	17.6	48.2	43.6
Tars	40.4	29.6	31.8				33.8	20.4	22.6
Bitumen	3.5	7.1	6.2	36.4	37.7	37.6	8.8	16.6	15.2
Resins/Others	21.1	14.6	15.9	9.1	2.6	3.2	19.1	10.9	12.2
Beeswax	10.5	16.6	15.3		2.6	2.4	8.8	12.3	11.5
Animal Glues	1.8	3.2	2.9		0.9	0.8	1.5	2.5	2.3
Unidentified	45.6	9.1	15.9	27.3	8.8	10.4	42.6	9	14.3

Table 13. General adhesive class interpretations, divided by region and period.

Specific Identification	Region and Period																	
	Europe						Near East						Total					
	Mesolithic		Neolithic		Total		Late Epipaleolithic		Neolithic		Total		LE/ Mesolithic		Neolithic		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Clay Plaster	4	100	31	31.6	35	34.3			25	16.9	25	15.8	4	28.6	56	22.8	60	23.1
Lime Plaster			6	6.1	6	5.9	6	60	37	25	43	27.2	6	42.9	43	17.5	49	18.8
Mud Plaster							2	20	26	17.6	28	17.7	2	14.3	26	10.6	28	10.8
Gypsum Plaster									20	13.5	20	12.7			20	8.1	20	7.7
Dung Plaster			3	3.1	3	2.9									3	1.2	3	1.2
Chalk Plaster			1	1	1	1			1	0.7	1	0.6			2	0.8	2	0.8
Loam Plaster									1	0.7	1	0.6			1	0.4	1	0.4
Marl Plaster									1	0.7	1	0.6			1	0.4	1	0.4
Unidentified Plaster			57	58.2	57	55.9	2	20	37	25	39	24.7	2	14.3	94	38.2	96	36.9
Plasters	**4**	**100**	**98**	**100**	**102**	**100**	**10**	**100**	**148**	**100**	**158**	**100**	**14**	**100**	**246**	**100**	**260**	**100**
Birch Bark Tar	18	78.3	64	79	82	78.8							18	78.3	64	79	82	78.8
Pine Bark Tar			3	3.7	3	2.9									3	3.7	3	2.9
Beech or Oak Tars			1	1.2	1	1									1	1.2	1	1
Birch Wood Tar			1	1.2	1	1									1	1.2	1	1
Unidentified Tars	5	21.7	12	14.8	17	16.3							5	21.7	12	14.8	17	16.3
Tars	**23**	**100**	**81**	**100**	**104**	**100**							**23**	**100**	**81**	**100**	**104**	**100**

Bitumen	**2**	**100**	**18**	**100**	**19**	**100**	**4**	**100**	**43**	**100**	**47**	**100**	**6**	**100**	**61**	**100**	**66**	**100**
Pine Resin	1	7.1	23	60.5	24	46.2							1	6.7	23	56.1	24	42.9
Conifer Resin	3	21.4	4	10.5	7	13.5							3	20	4	9.8	7	12.5
Cupressaceae Resin			2	5.3	2	3.8									2	4.9	2	3.6
Fir Resin	1	7.1			1	1.9							1	6.7			1	1.8
Pistacia Resin									1	33.3	1	25			1	2.4	1	1.8
Propolis Resin	1	7.1			1	1.9							1	6.7			1	1.8
Styrax Resin									1	33.3	1	25			1	2.4	1	1.8
Unidentified Resin	7	50	8	21.1	15	28.8	1	100	1	33.3	2	50	8	53.3	9	22	17	30.4
Algin			1	2.6	1	1.9									1	2.4	1	1.8
Fruit Gum	1	7.1			1	1.9							1	6.7			1	1.8
Resins/Others	**14**	**100**	**38**	**100**	**52**	**100**	**1**	**100**	**3**	**100**	**4**	**100**	**15**	**100**	**41**	**100**	**56**	**100**
Beeswax	**6**	**100**	**42**	**100**	**47**	**100**			**3**	**100**	**3**	**100**	**6**	**100**	**45**	**100**	**50**	**100**
Egg Glues			6	75	6	66.7									6	66.7	6	60
Collagen Glues			1	12.5	1	11.1			1	100	1	100			2	22.2	2	20
Unidentified Animal Glues	1	100	1	12.5	2	22.2							1	100	1	11.1	2	20
Animal Glues	**1**	**100**	**8**	**100**	**9**	**100**			**1**	**100**	**1**	**100**	**1**	**100**	**9**	**100**	**10**	**100**
Unidentified	**26**	**100**	**23**	**100**	**49**	**100**	**3**	**100**	**10**	**100**	**13**	**100**	**29**	**100**	**33**	**100**	**62**	**100**
Total	**76**		**307**		**381**		**18**		**207**		**225**		**94**		**514**		**606**	

Table 14. Specific adhesive class interpretations, divided by region and period.

Specific Identification	Region and Period																	
	Europe						Near East						Total					
	Mesolithic		Neolithic		Total		Late Epipaleolithic		Neolithic		Total		LE/ Mesolithic		Neolithic		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Plasters																		
Chemical Analysis	3	*75*	16	*17.6*	19	*20*	4	*50*	29	*33.7*	33	*35.1*	7	*58.3*	45	*25.4*	52	*27.5*
Optical Microscopy	3	*75*	19	*20.9*	22	*23.2*	5	*62.5*	26	*30.2*	31	*33*	8	*66.7*	45	*25.4*	53	*28*
Physical Examination	2	*50*	24	*26.4*	26	*27.4*	4	*50*	40	*46.5*	44	*46.8*	6	*50*	64	*36.2*	70	*37*
No Analysis	1	*25*	61	*67*	62	*65.3*	4	*50*	49	*57*	53	*56.4*	5	*41.7*	110	*62.1*	115	*60.8*
Tars																		
Chemical Analysis	13	*56.5*	56	*74.7*	69	*70.4*							13	*56.5*	56	*74.7*	69	*70.4*
Optical Microscopy	8	*34.8*	18	*24*	26	*26.5*							8	*34.8*	18	*24*	26	*26.5*
Physical Examination	12	*52.2*	18	*24*	30	*30.6*							12	*52.2*	18	*24*	30	*30.6*
No Analysis	7	*30.4*	6	*8*	13	*13.3*							7	*30.4*	6	*8*	13	*13.3*
Bitumen																		
Chemical Analysis	2	*100*	7	*38.9*	9	*47.4*	2	*50*	13	*30.2*	15	*31.9*	4	*66.7*	20	*32.8*	24	*36.4*
Optical Microscopy	2	*100*	2	*11.1*	4	*21.1*	2	*50*	11	*25.6*	13	*27.7*	4	*66.7*	13	*21.3*	17	*25.8*
Physical Examination			8	*44.4*	8	*42.1*			26	*60.5*	26	*55.3*			34	*55.7*	34	*51.5*
No Analysis			2	*11.1*	2	*10.5*	1	*25*	17	*39.5*	18	*38.3*	1	*16.7*	19	*31.1*	20	*30.3*

Resins/Others																		
Chemical Analysis	7	*58.3*	31	*83.8*	38	*77.6*			2	*66.7*	2	*50*	7	*53.8*	33	*82.5*	40	*75.5*
Optical Microscopy	6	*50*	8	*21.6*	14	*28.6*	1	*100*	1	*33.3*	2	*50*	7	*53.8*	9	*22.5*	16	*30.2*
Physical Examination	4	*33.3*	3	*8.1*	7	*14.3*	1	*100*	2	*66.7*	3	*75*	5	*38.5*	5	*12.5*	10	*18.9*
No Analysis	2	*16.7*	4	*10.8*	6	*12.2*			2	*66.7*	2	*50*	2	*15.4*	6	*15*	8	*15.1*
Beeswax																		
Chemical Analysis	4	*66.7*	42	*100*	46	*97.9*			3	*100*	3	*100*	4	*66.7*	45	*100*	49	*98*
Optical Microscopy	4	*66.7*	5	*11.9*	9	*19.1*							4	*66.7*	5	*11.1*	9	*18*
Physical Examination	1	*16.7*	1	*2.4*	2	*4.3*							1	*16.7*	1	*2.2*	2	*4*
No Analysis	1	*16.7*			1	*2.1*			3	*100*	3	*100*	1	*16.7*	3	*6.7*	4	*8*
Animal Glues																		
Chemical Analysis	1	*100*	7	*87.5*	8	*100*			1	*100*	1	*100*	1	*100*	8	*88.9*	9	*100*
Optical Microscopy	1	*100*	1	*12.5*	2	*25*			1	*100*	1	*100*	1	*100*	2	*22.2*	3	*33.3*
Physical Examination			1	*12.5*	1	*12.5*			1	*100*	1	*100*			2	*22.2*	2	*22.2*
No Analysis									1	*100*	1	*100*			1	*11.1*	1	*11.1*
Unidentified																		
Chemical Analysis	7	*26.9*	2	*8.7*	9	*18.4*			1	*10*	1	*7.7*	7	*24.1*	3	*9.1*	10	*16.1*
Optical Microscopy	15	*57.7*	8	*34.8*	23	*46.9*	2	*66.7*	1	*10*	3	*23.1*	17	*58.6*	9	*27.3*	26	*41.9*
Physical Examination	13	*50*	11	*47.8*	24	*49*	1	*33.3*	6	*60*	7	*53.8*	14	*48.3*	17	*51.5*	31	*50*
No Analysis	5	*19.2*	10	*43.5*	15	*30.6*	1	*33.3*	5	*50*	6	*46.2*	6	*20.7*	15	*45.5*	21	*33.9*

Table 15. Analytical techniques utilised to examine general adhesive classes, divided by region and period.

	Region and Period								
	Europe			**Near East**			**Total**		
Adhesive Use	**Mesolithic**	**Neolithic**	**Total**	**Late Epipaleolithic**	**Neolithic**	**Total**	**LE/ Mesolithic**	**Neolithic**	**Total**
Total Sites	57	253	308	11	114	125	68	367	433
No Uses									
Application	6	124	130	6	84	90	12	208	220
Burning		4	4					4	4
Chewing	9	12	21				9	12	21
Gluing	44	80	123	8	38	46	52	118	169
Manufacture	1	1	2		20	20	1	21	22
Processing/Production	3	7	10	1	7	8	4	14	18
Unidentified	11	87	98	1	22	23	12	109	121
	74	**315**	**388**	**16**	**171**	**187**	**90**	**486**	**575**
% Uses									
Application	8.1	39.4	33.5	37.5	49.1	48.1	13.3	42.8	38.3
Burning		1.3	1					0.8	0.7
Chewing	12.2	3.8	5.4				10	2.5	3.7
Gluing	59.5	25.4	31.7	50	22.2	24.6	57.8	24.3	29.4
Manufacture	1.4	0.3	0.5		11.7	10.7	1.1	4.3	3.8
Processing/Production	4.1	2.2	2.6	6.3	4.1	4.3	4.4	2.9	3.1
Unidentified	14.9	27.6	25.3	6.3	12.9	12.3	13.3	22.4	21
	100	**100**	**100**	**100**	**100**	**100**	**100**	**100**	**100**

% Sites									
Application	**10.5**	**49**	**42.2**	**54.5**	**73.7**	**72**	**17.6**	**56.7**	**50.8**
Burning		**1.6**	**1.3**					**1.1**	**0.9**
Chewing	**15.8**	**4.7**	**6.8**				**13.2**	**3.3**	**4.8**
Gluing	**77.2**	**31.6**	**39.9**	**72.7**	**33.3**	**36.8**	**76.5**	**32.2**	**39**
Manufacture	**1.8**	**0.4**	**0.6**		**17.5**	**16**	**1.5**	**5.7**	**5.1**
Processing/Production	**5.3**	**2.8**	**3.2**	**9.1**	**6.1**	**6.4**	**5.9**	**3.8**	**4.2**
Unidentified	**19.3**	**34.4**	**31.8**	**9.1**	**19.3**	**18.4**	**17.6**	**29.7**	**27.9**

Table 16. General use interpretations, divided by region and period.

Specific Identification	**Region and Period**																	
	Europe						**Near East**						**Total**					
	Mesolithic		**Neolithic**		**Total**		**Late Epipaleolithic**		**Neolithic**		**Total**		**LE/ Mesolithic**		**Neolithic**		**Total**	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Architectural	1	14.3	73	52.9	74	51	5	83.3	73	61.9	78	62.9	6	46.2	146	57	152	56.5
Binder			9	6.5	9	6.2			1	0.8	1	0.8			10	3.9	10	3.7
Object Decoration	2	28.6	13	9.4	15	10.3	1	16.7	12	10.2	13	10.5	3	23.1	25	9.8	28	10.4
Object Manufacture									2	1.7	2	1.6			2	0.8	2	0.7
Container Decoration			23	16.7	23	15.9			3	2.5	3	2.4			26	10.2	26	9.7
Caulking	1	14.3			1	0.7			3	2.5	3	2.4	1	7.7	3	1.2	4	1.5
Medicinal			1	0.7	1	0.7									1	0.4	1	0.4
Repairing									1	0.8	1	0.8			1	0.4	1	0.4
Sealing	3	42.9	19	13.8	22	15.2			23	19.5	23	18.5	3	23.1	42	16.4	45	16.7
Application	**7**	**100**	**138**	**100**	**145**	**100**	**6**	**100**	**118**	**100**	**124**	**100**	**13**	**100**	**256**	**100**	**269**	**100**
Incense			4	57.1	4	57.1									4	57.1	4	57.1
Fuel			1	14.3	1	14.3									1	14.3	1	14.3
Hygiene			1	14.3	1	14.3									1	14.3	1	14.3
Medicinal			1	14.3	1	14.3									1	14.3	1	14.3
Burning			7	100	7	100									7	100	7	100
Hygienic	2	13.3	1	5.9	3	9.4							2	13.3	1	5.9	3	9.4
Medicinal	6	40	5	29.4	11	34.4							6	40	5	29.4	11	34.4

Processing	5	*33.3*	6	*35.3*	11	*34.4*							5	*33.3*	6	*35.3*	11	*34.4*
Unknown	2	*13.3*	5	*29.4*	7	*21.9*							2	*13.3*	5	*29.4*	7	*21.9*
Chewing	**15**	***100***	**17**	***100***	**32**	***100***							**15**	***100***	**17**	***100***	**32**	***100***
Hafting	41	*93.2*	58	*61.1*	98	*71*	7	*87.5*	36	*87.8*	43	*87.7*	48	*92.3*	94	*69.1*	142	*75.5*
Object Decoration	1	*2.3*	1	*1.1*	2	*1.4*			1	*2.4*	1	*2*	1	*1.9*	2	*1.5*	3	*1.6*
Object Manufacture	1	*2.3*	6	*6.3*	7	*5.1*			1	*2.4*	1	*2*	1	*1.9*	7	*5.1*	8	*4.3*
Repairing	1	*2.3*	24	*25.3*	25	*18.1*			1	*2.4*	1	*2*	1	*1.9*	25	*18.4*	26	*13.8*
Container Manufacture			4	*4.2*	4	*2.9*									4	*2.9*	4	*2.1*
Fletching			1	*1.1*	1	*0.7*									1	*0.7*	1	*0.5*
Architectural							1	*12.5*	2	*4.9*	3	*6.1*	1	*1.9*	2	*1.5*	3	*1.6*
Backing			1	*1.1*	1	*0.7*									1	*0.7*	1	*0.5*
Gluing	**44**	***100***	**95**	***100***	**138**	***100***	**8**	***100***	**41**	***100***	**48**	***100***	**52**	***100***	**136**	***100***	**188**	***100***
Container Manufacture			1	*100*	1	*50*			14	*66.7*	14	*66.7*			15	*68.2*	15	*65.2*
Object Manufacture									5	*23.8*	5	*23.8*			5	*22.7*	5	*21.7*
Sealing									2	*9.5*	2	*9.5*			2	*9.1*	2	*8.7*
Storage	1	*100*			1	*50*							1	*100*			1	*4.3*
Manufacture	**1**	***100***	**1**	***100***	**2**	***100***			**21**	***100***	**21**	***100***	**1**	***100***	**22**	***100***	**23**	***100***
Processing	2	*66.7*	4	*57.1*	6	*60*			3	*42.9*	3	*37.5*	2	*50*	7	*50*	9	*50*
Production	1	*33.3*	3	*42.9*	4	*40*	1	*100*	4	*57.1*	5	*62.5*	2	*50*	7	*50*	9	*50*
Processing/Production	**3**	***100***	**7**	***100***	**10**	***100***	**1**	***100***	**7**	***100***	**8**	***100***	**4**	***100***	**14**	***100***	**18**	***100***
Flavouring			5	*5.3*	5	*4.8*									5	*4.3*	5	*3.9*
Hygienic			1	*1.1*	1	*1*									1	*0.9*	1	*0.8*

Medicinal	1	*9.1*	1	*1.1*	2	*1.9*							1	*8.3*	1	*0.9*	2	*1.6*
Preservative			1	*1.1*	1	*1*			1	*4.5*	1	*4.3*			2	*1.7*	2	*1.6*
Storage	1	*9.1*	3	*3.2*	4	*3.8*			3	*13.6*	3	*13*	1	*8.3*	6	*5.2*	7	*5.5*
Unknown	9	*81.8*	83	*88.3*	92	*87.6*	1	*100*	18	*81.8*	19	*82.6*	10	*83.3*	101	*87.1*	111	*86.7*
Unknown	**11**	***100***	**94**	***100***	**105**	***100***	**1**	***100***	**22**	***100***	**23**	***100***	**12**	***100***	**116**	***100***	**128**	***100***
	81		**359**		**439**		**16**		**209**		**224**		**97**		**568**		**665**	

Table 17. Specific use interpretations, divided by region and period.

Specific Identification	Region and Period																	
	Europe						Near East						Total					
	Mesolithic		Neolithic		Total		Late Epipaleolithic		Neolithic		Total		LE/ Mesolithic		Neolithic		Total	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Application																		
Chemical Analysis	4	*66.7*	51	*41.1*	55	*42.3*	3	*50*	31	*36.9*	34	*37.8*	7	*58.3*	82	*39.4*	89	*40.5*
Optical Microscopy	2	*33.3*	26	*21*	28	*21.5*	3	*50*	22	*26.2*	25	*27.8*	5	*41.7*	48	*23.1*	53	*24.1*
Physical Examination	2	*33.3*	32	*25.8*	34	*26.2*	3	*50*	43	*51.2*	46	*51.1*	5	*41.7*	75	*36.1*	80	*36.4*
No Analysis	1	*16.7*	60	*48.4*	61	*46.9*	3	*50*	51	*60.7*	54	*60*	4	*33.3*	111	*53.4*	115	*52.3*
Burning																		
Chemical Analysis			4	*100*	4	*100*									4	*100*	4	*100*
Optical Microscopy																		
Physical Examination																		
No Analysis																		
Chewing																		
Chemical Analysis	7	*77.8*	6	*50*	13	*61.9*							7	*77.8*	6	*50*	13	*61.9*
Optical Microscopy			4	*33.3*	4	*19*									4	*33.3*	4	*19*
Physical Examination	3	*33.3*	4	*33.3*	7	*33.3*							3	*33.3*	4	*33.3*	7	*33.3*
No Analysis	3	*33.3*	6	*50*	9	*42.9*							3	*33.3*	6	*50*	9	*42.9*

Gluing																		
Chemical Analysis	13	*29.5*	44	*55*	56	*45.5*			6	*15.8*	6	*13*	13	*25*	50	*42.4*	62	*36.7*
Optical Microscopy	28	*63.6*	24	*30*	51	*41.5*	5	*62.5*	12	*31.6*	17	*37*	33	*63.5*	36	*30.5*	68	*40.2*
Physical Examination	23	*52.3*	32	*40*	55	*44.7*	4	*50*	25	*65.8*	29	*63*	27	*51.9*	57	*48.3*	84	*49.7*
No Analysis	12	*27.3*	14	*17.5*	26	*21.1*	2	*25*	16	*42.1*	18	*39.1*	14	*26.9*	30	*25.4*	44	*26*
Manufacture																		
Chemical Analysis	1	*100*			1	*50*			11	*55*	11	*55*	1	*100*	11	*52.4*	12	*54.5*
Optical Microscopy	1	*100*			1	*50*			9	*45*	9	*45*	1	*100*	9	*42.9*	10	*45.5*
Physical Examination	1	*100*	1	*100*	2	*100*			11	*55*	11	*55*	1	*100*	12	*57.1*	13	*59.1*
No Analysis									9	*45*	9	*45*			9	*42.9*	9	*40.9*
Processing/Production																		
Chemical Analysis	2	*66.7*	6	*85.7*	8	*80*	1	*100*	5	*71.4*	6	*75*	3	*75*	11	*78.6*	14	*77.8*
Optical Microscopy	1	*33.3*	3	*42.9*	4	*40*			4	*57.1*	4	*50*	1	*25*	7	*50*	8	*44.4*
Physical Examination	2	*66.7*	2	*28.6*	4	*40*	1	*100*	5	*71.4*	6	*75*	3	*75*	7	*50*	10	*55.6*
No Analysis	1	*33.3*	1	*14.3*	2	*20*	1	*100*	2	*28.6*	3	*37.5*	2	*50*	3	*21.4*	5	*27.8*
Unknown																		
Chemical Analysis	10	*90.9*	69	*79.3*	79	*80.6*			14	*63.6*	14	*60.9*	10	*83.3*	83	*76.1*	93	*76.9*
Optical Microscopy	3	*27.3*	11	*12.6*	14	*14.3*	1	*100*	5	*22.7*	6	*26.1*	4	*33.3*	16	*14.7*	20	*16.5*
Physical Examination	4	*36.4*	8	*9.2*	12	*12.2*	1	*100*	13	*59.1*	14	*60.9*	5	*41.7*	21	*19.3*	26	*21.5*
No Analysis	3	*27.3*	14	*16.1*	17	*17.3*			7	*31.8*	7	*30.4*	3	*25*	21	*19.3*	24	*19.8*

Table 18. Analytical techniques utilised to examine general use interpretations, divided by region and period.

General Adhesive Classes by Use	Region and Period																	
	Europe						Near East						Total					
	Mesolithic		Neolithic		Total		Late Epipaleolithic		Neolithic		Total		LE/ Mesolithic		Neolithic		Total	
	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%	No	%
Application			6	75	6	66.7			1	50	1	50			7	70	7	63.6
Gluing	1	100	2	25	3	33.3			1	50	1	50	1	100	3	30	4	36.4
Animal Glues	**1**	**100**	**8**	**100**	**9**	**100**			**2**	**100**	**2**	**100**	**1**	**100**	**10**	**100**	**11**	**100**
Application	1	14.3	7	14.3	8	14.5							1	14.3	7	13.5	8	13.8
Burning			1	2	1	1.8									1	1.9	1	1.7
Chewing			1	2	1	1.8									1	1.9	1	1.7
Gluing	3	42.9	1	2	3	5.5							3	42.9	1	1.9	3	5.2
Manufacture	1	14.3			1	1.8							1	14.3			1	1.7
Processing/Production			1	2	1	1.8									1	1.9	1	1.7
Unknown	2	28.6	38	77.6	40	72.7			3	100	3	100	2	28.6	41	78.8	43	74.1
Beeswax	**7**	**100**	**49**	**100**	**55**	**100**			**3**	**100**	**3**	**100**	**7**	**100**	**52**	**100**	**58**	**100**
Application			2	10.5	2	10	1	25	22	32.8	23	32.4	1	16.7	24	27.9	25	27.5
Gluing	2	100	15	78.9	16	80	3	75	26	38.8	29	40.8	5	83.3	41	47.7	45	49.5
Manufacture			1	5.3	1	5			5	7.5	5	7			6	7	6	6.6
Processing/Production									3	4.5	3	4.2			3	3.5	3	3.3
Unknown			1	5.3	1	5			11	16.4	11	15.5			12	14	12	13.2
Bitumen	**2**	**100**	**19**	**100**	**20**	**100**	**4**	**100**	**67**	**100**	**71**	**100**	**6**	**100**	**86**	**100**	**91**	**100**

Application	1	*20*	75	*79.8*	76	*76.8*	5	*55.6*	75	*68.8*	80	*67.8*	6	*42.9*	150	*73.9*	156	*71.9*
Gluing	1	*20*	2	*2.1*	3	*3*	2	*22.2*	8	*7.3*	10	*8.5*	3	*21.4*	10	*4.9*	13	*6*
Manufacture	1	*20*			1	*1*			16	*14.7*	16	*13.6*	1	*7.1*	16	*7.9*	17	*7.8*
Processing/Production			1	*1.1*	1	*1*	1	*11.1*	4	*3.7*	5	*4.2*	1	*7.1*	5	*2.5*	6	*2.8*
Unknown	2	*40*	16	*17*	18	*18.2*	1	*11.1*	6	*5.5*	7	*5.9*	3	*21.4*	22	*10.8*	25	*11.5*
Plasters	**5**	***100***	**94**	***100***	**99**	***100***	**9**	***100***	**109**	***100***	**118**	***100***	**14**	***100***	**203**	***100***	**217**	***100***
Application	1	*3.3*	30	*28*	31	*22.6*							1	*3.3*	30	*28*	31	*22.6*
Burning			3	*2.8*	3	*2.2*									3	*2.8*	3	*2.2*
Chewing	8	*26.7*	9	*8.4*	17	*12.4*							8	*26.7*	9	*8.4*	17	*12.4*
Gluing	15	*50*	43	*40.2*	58	*42.3*							15	*50*	43	*40.2*	58	*42.3*
Manufacture	1	*3.3*			1	*0.7*							1	*3.3*			1	*0.7*
Processing/Production	2	*6.7*	5	*4.7*	7	*5.1*							2	*6.7*	5	*4.7*	7	*5.1*
Unknown	3	*10*	17	*15.9*	20	*14.6*							3	*10*	17	*15.9*	20	*14.6*
Tars	**30**	***100***	**107**	***100***	**137**	***100***							**30**	***100***	**107**	***100***	**137**	***100***
Application	3	*21.4*	12	*27.9*	15	*26.3*			2	*50*	2	*40*	3	*20*	14	*29.8*	17	*27.4*
Burning			1	*2.3*	1	*1.8*									1	*2.1*	1	*1.6*
Chewing			2	*4.7*	2	*3.5*									2	*4.3*	2	*3.2*
Gluing	7	*50*	8	*18.6*	15	*26.3*	1	*100*			1	*20*	8	*53.3*	8	*17*	16	*25.8*
Unknown	4	*28.6*	20	*46.5*	24	*42.1*			2	*50*	2	*40*	4	*26.7*	22	*46.8*	26	*41.9*
Resins/Others	**14**	***100***	**43**	***100***	**57**	***100***	**1**	***100***	**4**	***100***	**5**	***100***	**15**	***100***	**47**	***100***	**62**	***100***
Application	1	*3.4*	1	*4.3*	2	*3.8*			2	*18.2*	2	*14.3*	1	*3.1*	3	*8.8*	4	*6.1*

Chewing	1	*3.4*	1	*4.3*	2	*3.8*							1	*3.1*	1	*2.9*	2	*3*
Gluing	21	*72.4*	18	*78.3*	39	*75*	3	*100*	9	*81.8*	12	*85.7*	24	*75*	27	*79.4*	51	*77.3*
Processing/Production	1	*3.4*			1	*1.9*							1	*3.1*			1	*1.5*
Unknown	5	*17.2*	3	*13*	8	*15.4*							5	*15.6*	3	*8.8*	8	*12.1*
Unidentified	**29**	***100***	**23**	***100***	**52**	***100***	**3**	***100***	**11**	***100***	**14**	***100***	**32**	***100***	**34**	***100***	**66**	***100***
Total	**88**		**343**		**429**		**17**		**196**		**213**		**105**		**539**		**642**	

Table 19. General adhesive classes by general use interpretations, divided by region and period.

		Region and Period																	
		Europe						**Near East**						**Total**					
Adhesive Class	**General Use**	**Mesolithic**		**Neolithic**		**Total**		**Late Epipaleolithic**		**Neolithic**		**Total**		**LE/ Mesolithic**		**Neolithic**		**Total**	
		No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Animal Glues																			
Egg	Application			6	*100%*	6	*100%*									6	*100%*	6	*100%*
Collagen	Application									1	*50%*	1	*50%*			1	*33.3%*	1	*33.3%*
	Gluing			1	*100%*	1	*100%*			1	*50%*	1	*50%*			2	*66.7%*	2	*66.7%*
	Total			**1**	**100%**	**1**	**100%**			**2**	**100%**	**2**	**100%**			**3**	**100%**	**3**	**100%**
Unidentified	Gluing	1	*100%*	1	*100%*	2	*100%*							1	*100%*	1	*100%*	2	*100%*
Plasters																			
Clay	Application	1	*20%*	25	*78.1%*	26	*70.3%*			21	*77.8%*	21	*77.8%*	1	*20%*	46	*78%*	47	*73.4%*
	Manufacture	1	*20%*			1	*2.7%*			4	*14.8%*	4	*14.8%*	1	*20%*	4	*6.8%*	5	*7.8%*
	Gluing	1	*20%*			1	*2.7%*			1	*3.7%*	1	*3.7%*	1	*20%*	1	*1.7%*	2	*3.1%*
	Unknown	2	*40%*	7	*21.9%*	9	*24.3%*			1	*3.7%*	1	*3.7%*	2	*40%*	8	*13.6%*	10	*15.6%*
	Total	**5**	**100%**	**32**	**100%**	**37**	**100%**			**27**	**100%**	**27**	**100%**	**5**	**100%**	**59**	**100%**	**64**	**100%**
Chalk	Application			1	*100%*	1	*100%*			1	*100%*	1	*100%*			2	*100%*	2	*100%*
Dung	Application			3	*100%*	3	*100%*									3	*100%*	3	*100%*
Gypsum	Application									18	*66.7%*	18	*66.7%*			18	*66.7%*	18	*66.7%*
	Manufacture									4	*14.8%*	4	*14.8%*			4	*14.8%*	4	*14.8%*
	Proc/Prod									3	*11.1%*	3	*11.1%*			3	*11.1%*	3	*11.1%*

	Gluing							1	3.7%	1	3.7%			1	3.7%	1	3.7%
	Unknown							1	3.7%	1	3.7%			1	3.7%	1	3.7%
	Total							**27**	**100%**	**27**	**100%**			**27**	**100%**	**27**	**100%**
Lime	Application	5	62.5%	5	62.5%	3	42.9%	32	65.3%	35	62.5%	3	42.9%	37	64.9%	40	62.5%
	Proc/Prod	1	12.5%	1	12.5%	1	14.3%	5	10.2%	6	10.7%	1	14.3%	6	10.5%	7	10.9%
	Gluing	1	12.5%	1	12.5%	2	28.6%	3	6.1%	5	8.9%	2	28.6%	4	7%	6	9.4%
	Manufacture							7	14.3%	7	12.5%			7	12.3%	7	10.9%
	Unknown	1	12.5%	1	12.5%	1	14.3%	2	4.1%	3	5.4%	1	14.3%	3	5.3%	4	6.3%
	Total	8	100%	8	100%	7	100%	49	100%	56	100%	7	100%	57	100%	64	100%
Loam	Application							1	100%	1	100%			1	100%	1	100%
Marl	Application							1	100%	1	100%			1	100%	1	100%
Mud	Application					2	100%	24	88.9%	26	89.7%	2	100%	24	88.9%	26	89.7%
	Gluing							2	7.4%	2	6.9%			2	7.4%	2	6.9%
	Manufacture							1	3.7%	1	3.4%			1	3.7%	1	3.4%
	Total					**2**	**100%**	**27**	**100%**	**29**	**100%**	**2**	**100%**	**27**	**100%**	**29**	**100%**
Unidentified	Application	48	84.2%	48	84.2%	2	66.7%	33	70.2%	35	70%	2	66.7%	81	77.9%	83	77.6%
	Gluing	1	1.8%	1	1.8%	1	33.3%	2	4.3%	3	6%	1	33.3%	3	2.9%	4	3.7%
	Manufacture							7	14.9%	7	14%			7	6.7%	7	6.5%
	Proc/Prod							2	4.3%	2	4%			2	1.9%	2	1.9%
	Unknown	8	14%	8	14%			3	6.4%	3	6%			11	10.6%	11	10.3%
	Total	**57**	**100%**	**57**	**100%**	**3**	**100%**	**47**	**100%**	**50**	**100%**	**3**	**100%**	**104**	**100%**	**107**	**100%**
Tars																	
Beech or Oak	Application	1	50%	1	50%									1	50%	1	50%
	Unknown	1	50%	1	50%									1	50%	1	50%

	Total			**2**	**100%**	**2**	**100%**			**2**	**100%**	**2**	**100%**
Birch Bark	Gluing	10	*38.5%*	39	*43.3%*	49	*42.2%*	10	*38.5%*	39	*43.3%*	49	*42.2%*
	Chewing	9	*34.6%*	7	*7.8%*	16	*13.8%*	9	*34.6%*	7	*7.8%*	16	*13.8%*
	Application	1	*3.8%*	22	*24.4%*	23	*19.8%*	1	*3.8%*	22	*24.4%*	23	*19.8%*
	Manufacture	1	*3.8%*			1	*0.9%*	1	*3.8%*			1	*0.9%*
	Proc/Prod	2	*7.7%*	4	*4.4%*	6	*5.2%*	2	*7.7%*	4	*4.4%*	6	*5.2%*
	Burning			2	*2.2%*	2	*1.7%*			2	*2.2%*	2	*1.7%*
	Unknown	3	*11.5%*	16	*17.8%*	19	*16.4%*	3	*11.5%*	16	*17.8%*	19	*16.4%*
	Total	**26**	**100%**	**90**	**100%**	**116**	**100%**	**26**	**100%**	**90**	**100%**	**116**	**100%**
Birch Wood	Gluing			1	*100%*	1	*100%*			1	*100%*	1	*100%*
Pine Bark	Application			3	*42.9%*	3	*42.9%*			3	*42.9%*	3	*42.9%*
	Gluing			1	*14.3%*	1	*14.3%*			1	*14.3%*	1	*14.3%*
	Chewing			1	*14.3%*	1	*14.3%*			1	*14.3%*	1	*14.3%*
	Unknown			2	*28.6%*	2	*28.6%*			2	*28.6%*	2	*28.6%*
	Total			**7**	**100%**	**7**	**100%**			**7**	**100%**	**7**	**100%**
Unidentified	Gluing	5	*100%*	5	*33.3%*	10	*50%*	5	*100%*	5	*33.3%*	10	*50%*
	Application			7	*46.7%*	7	*35%*			7	*46.7%*	7	*35%*
	Burning			1	*6.7%*	1	*5%*			1	*6.7%*	1	*5%*
	Chewing			1	*6.7%*	1	*5%*			1	*6.7%*	1	*5%*
	Proc/Prod			1	*6.7%*	1	*5%*			1	*6.7%*	1	*5%*
	Total	**5**	**100%**	**15**	**100%**	**20**	**100%**	**5**	**100%**	**15**	**100%**	**20**	**100%**
Resins/ Others													
Conifer	Gluing	3	*100%*			3	*37.5%*	3	*100%*			3	*37.5%*
	Burning			1	*20%*	1	*12.5%*			1	*20%*	1	*12.5%*

	Application			2	*40%*	2	*25%*									2	*40%*	2	*25%*
	Unknown			2	*40%*	2	*25%*									2	*40%*	2	*25%*
	Total	**3**	**100%**	**5**	**100%**	**8**	**100%**							**3**	**100%**	**5**	**100%**	**8**	**100%**
Pine	Application			7	*25.9%*	7	*25%*									7	*25.9%*	7	*25%*
	Gluing			4	*14.8%*	4	*14.3%*									4	*14.8%*	4	*14.3%*
	Unknown	1	*100%*	16	*59.3%*	17	*60.7%*							1	*100%*	16	*59.3%*	17	*60.7%*
	Total	**1**	**100%**	**27**	**100%**	**28**	**100%**							**1**	**100%**	**27**	**100%**	**28**	**100%**
Fir	Gluing	1	*50%*			1	*50%*							1	*50%*			1	*50%*
	Unknown	1	*50%*			1	*50%*							1	*50%*			1	*50%*
	Total	**2**	**100%**			**2**	**100%**							**2**	**100%**			**2**	**100%**
Propolis	Unknown	**1**	***100%***			**1**	***100%***							**1**	***100%***			**1**	***100%***
Cupressaceae	Application			1	*33.3%*	1	*25%*									1	*33.3%*	1	*25%*
	Burning			1	*33.3%*	1	*25%*									1	*33.3%*	1	*25%*
	Unknown	1	*100%*	1	*33.3%*	2	*50%*							1	*100%*	1	*33.3%*	2	*50%*
	Total	**1**	***100%***	**3**	***100%***	**4**	***100%***							**1**	***100%***	**3**	***100%***	**4**	***100%***
Pistacia	Application									1	*50%*	1	*50%*			1	*50%*	1	*50%*
	Unknown									1	*50%*	1	*50%*			1	*50%*	1	*50%*
	Total									**2**	**100%**	**2**	**100%**			**2**	**100%**	**2**	**100%**
Styrax Resin	Application									1	*100%*	1	*100%*			1	*100%*	1	*100%*
Unidentified Resin	Gluing	3	*42.9%*	4	*44.4%*	7	*43.8%*	2	*100%*			2	*66.7%*	5	*55.6%*	4	*40%*	9	*47.4%*
	Application	3	*42.9%*	2	*22.2%*	5	*31.3%*							3	*33.3%*	2	*20%*	5	*26.3%*
	Chewing			2	*22.2%*	2	*12.5%*									2	*20%*	2	*10.5%*
	Unknown	1	*14.3%*	1	*11.1%*	2	*12.5%*			1	*100%*	1	*33.3%*	1	*11.1%*	2	*20%*	3	*15.8%*
	Total	**7**	**100%**	**9**	**100%**	**16**	**100%**	**2**	**100%**	**1**	**100%**	**3**	**100%**	**9**	**100%**	**10**	**100%**	**19**	**100%**

Algin	Application			1	*100%*	1	*100%*									1	*100%*	1	*100%*
Fruit Gum	Gluing	1	*100%*			1	*100%*							1	*100%*			1	*100%*

Table 20. Specific adhesive classes by general use interpretations, divided by region and period.

	Region and Period																	
	Europe						**Near East**						**Total**					
	Mesolithic		**Neolithic**		**Total**		**Late Epipaleolithic**		**Neolithic**		**Total**		**LE/ Mesolithic**		**Neolithic**		**Total**	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Sites with Aggregates	6	*10.5*	31	*12.3*	37	*12*	3	*27.3*	30	*26.3*	33	*26.4*	9	*13.2*	61	*16.6*	70	*16.2*
Aggregate Type																		
Anhydrite									1	*1.3*	1	*1.2*			1	*0.7*	1	*0.7*
Ash			2	*3.6*	2	*3.1*	1	*33.3*	4	*5.1*	5	*6.1*	1	*8.3*	6	*4.4*	7	*4.8*
Barnacle Fragments									1	*1.3*	1	*1.2*			1	*0.7*	1	*0.7*
Calcite	1	*11.1*			1	*1.5*			11	*13.9*	11	*13.4*	1	*8.3*	11	*8.1*	12	*8.2*
Chalk									4	*5.1*	4	*4.9*			4	*3*	4	*2.7*
Charcoal	4	*44.4*	2	*3.6*	6	*9.2*			6	*7.6*	6	*7.3*	4	*33.3*	8	*5.9*	12	*8.2*
Coal	1	*11.1*			1	*1.5*							1	*8.3*			1	*0.7*
Feldspar			2	*3.6*	2	*3.1*			1	*1.3*	1	*1.2*			3	*2.2*	3	*2*
Gravel			1	*1.8*	1	*1.5*			1	*1.3*	1	*1.2*			2	*1.5*	2	*1.4*
Gypsum									1	*1.3*	1	*1.2*			1	*0.7*	1	*0.7*
Lignite			1	*1.8*	1	*1.5*									1	*0.7*	1	*0.7*
Limestone			2	*3.6*	2	*3.1*			6	*7.6*	6	*7.3*			8	*5.9*	8	*5.4*
Mica			3	*5.4*	3	*4.6*									3	*2.2*	3	*2*
Obsidian Fragments			1	*1.8*	1	*1.5*									1	*0.7*	1	*0.7*
Ochre	1	*11.1*	2	*3.6*	3	*4.6*	1	*33.3*	4	*5.1*	5	*6.1*	2	*16.7*	6	*4.4*	8	*5.4*

Pebbles			1	1.8	1	1.5			2	2.5	2	2.4			3	2.2	3	2
Plaster Chunks									3	3.8	3	3.7			3	2.2	3	2
Quartz	1	11.1	6	10.7	7	10.8			9	11.4	9	11	1	8.3	15	11.1	16	10.9
Sand			7	12.5	7	10.8			6	7.6	6	7.3			13	9.6	13	8.8
Sandstone									2	2.5	2	2.4			2	1.5	2	1.4
Shell			1	1.8	1	1.5			1	1.3	1	1.2			2	1.5	2	1.4
Silt			1	1.8	1	1.5			1	1.3	1	1.2			2	1.5	2	1.4
Soil			1	1.8	1	1.5	1	33.3	1	1.3	2	2.4	1	8.3	2	1.5	3	2
Tufa			1	1.8	1	1.5									1	0.7	1	0.7
Tuff									1	1.3	1	1.2			1	0.7	1	0.7
Unidentified	1	11.1	7	12.5	8	12.3			2	2.5	2	2.4	1	8.3	9	6.7	10	6.8
Vegetal			15	26.8	15	23.1			11	13.9	11	13.4			26	19.3	26	17.7
	9	**100**	**56**	**100**	**65**	**100**	**3**	**100**	**79**	**100**	**82**	**100**	**12**	**100**	**135**	**100**	**147**	**100**
Maximum Number of Aggregates in Adhesive																		
1	4	66.7	23	74.2	27	73	3	100	15	50	18	54.5	7	77.8	38	62.3	45	64.3
2	1	16.7	1	3.2	2	5.4			6	20	6	18.2	1	11.1	7	11.5	8	11.4
3	1	16.7	4	12.9	5	13.5			5	16.7	5	15.2	1	11.1	9	14.8	10	14.3
4			2	6.5	2	5.4			4	13.3	4	12.1			6	9.8	6	8.6
5			1	3.2	1	2.7									1	1.6	1	1.4
	6	**100**	**31**	**100**	**37**	**100**	**3**	**100**	**30**	**100**	**33**	**100**	**9**	**100**	**61**	**100**	**70**	**100**

Aggregate Inclusion by General Adhesive Class																		
Animal Glues	1	*14.3*			1	*2.6*							1	*10*			1	*1.4*
Beeswax					-	-												
Bitumen			1	*3.2*	1	*2.6*			5	*15.6*	5	*14.3*			6	*9.5*	6	*8.2*
Plasters			19	*61.3*	19	*50*	1	*33.3*	27	*84.4*	28	*80*	1	*10*	46	*73*	47	*64.4*
Tars			8	*25.8*	8	*21.1*									8	*12.7*	8	*11*
Resins/Others	4	*57.1*	2	*6.5*	6	*15.8*							4	*40*	2	*3.2*	6	*8.2*
Unidentified	2	*28.6*	1	*3.2*	3	*7.9*	2	*66.7*			2	*5.7*	4	*40*	1	*1.6*	5	*6.8*
	7	***100***	**31**	***100***	**38**	***100***	**3**	***100***	**32**	***100***	**35**	***100***	**10**	***100***	**63**	***100***	**73**	***100***
Aggregate Inclusion by General Adhesive Use																		
Application			21	*63.6*	21	*53.8*	1	*33.3*	25	*67.6*	26	*65*	1	*11.1*	46	*65.7*	47	*59.5*
Burning			1	*3*	1	*2.6*									1	*1.4*	1	*1.3*
Chewing																		
Gluing	5	*83.3*	6	*18.2*	11	*28.2*	2	*66.7*	3	*8.1*	5	*12.5*	7	*77.8*	9	*12.9*	16	*20.3*
Manufacture									7	*18.9*	7	*17.5*			7	*10*	7	*8.9*
Processing/Production																		
Unknown	1	*16.7*	5	*15.2*	5	*12.8*			2	*5.4*	2	*5*	1	*11.1*	7	*10*	8	*10.1*
	6	***100***	**33**	***100***	**39**	***100***	**3**	***100***	**37**	***100***	**40**	***100***	**9**	***100***	**70**	***100***	**79**	***100***

Sites with Additive Co-Usage																		
Aggregate-Plasticiser	3	*5.3*	2	*0.8*	5	*1.6*			1	*0.9*	1	*0.8*	3	*4.4*	3	*0.8*	6	*1.4*
Aggregate-Other Element	1	*1.8*	2	*0.8*	3	*1*	1	*9.1*	12	*10.5*	13	*10.4*	2	*2.9*	14	*3.8*	16	*3.7*

Table 21. Aggregates, divided by region, period, type, general adhesive class and general use.

	Region and Period																	
	Europe						**Near East**						**Total**					
	Mesolithic		**Neolithic**		**Total**		**Late Epipaleolithic**		**Neolithic**		**Total**		**LE/ Mesolithic**		**Neolithic**		**Total**	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Sites with Plasticisers	8	14	26	10.3	34	11			2	1.8	2	1.6	8	11.8	28	7.6	36	8.3
Plasticiser Type																		
Animal Fat	4	36.4	22	75.9	26	65			1	50	1	50	4	36.4	23	74.2	27	64.3
Beeswax	4	36.4	7	24.1	11	27.5							4	36.4	7	22.6	11	26.2
Clay Plaster	3	27.3			3	7.5			1	50	1	50	3	27.3	1	3.2	4	9.5
	11	**100**	**29**	**100**	**40**	**100**			**2**	**100**	**2**	**100**	**11**	**100**	**31**	**100**	**42**	**100**
Number of Plasticisers in Adhesive																		
1	6	75	25	92.6	31	88.6			2	100	2	100	6	75	27	93.1	33	89.2
2	2	25	2	7.4	4	11.4							2	25	2	6.9	4	10.8
	8	**100**	**27**	**100**	**35**	**100**			**2**	**100**	**2**	**100**	**8**	**100**	**29**	**100**	**37**	**100**
Plasticiser Inclusion by General Adhesive Class																		

Animal Glues	1	11.1			1	2.7					1	11.1			1	2.6
Beeswax			9	31	9	24.3	1	50	1	50			10	32.3	10	25.6
Bitumen	1	11.1	1	3.4	1	2.7	1	50	1	50	1	11.1	2	6.5	2	5.1
Plasters																
Tars	4	44.4	11	37.9	15	40.5					4	44.4	11	35.5	15	38.5
Resins/Others	2	22.2	8	27.6	10	27					2	22.2	8	25.8	10	25.6
Unidentified	1	11.1			1	2.7					1	11.1			1	2.6
	9	**100**	**29**	**100**	**37**	**100**	**2**	**100**	**2**	**100**	**9**	**100**	**31**	**100**	**39**	**100**
Plasticiser Inclusion by General Adhesive Use																
Application			9	25.7	9	21.4	1	50	1	50			10	27	10	22.7
Burning			2	5.7	2	4.8							2	5.4	2	4.5
Chewing			2	5.7	2	4.8							2	5.4	2	4.5
Gluing	5	62.5	8	22.9	12	28.6					5	62.5	8	21.6	12	27.3
Manufacture	1	12.5			1	2.4					1	12.5			1	2.3
Processing/Production																
Unknown	2	25	14	40	16	38.1	1	50	1	50	2	25	15	40.5	17	38.6
	8	**100**	**35**	**100**	**42**	**100**	**2**	**100**	**2**	**100**	**8**	**100**	**37**	**100**	**44**	**100**
Sites with Additive Co-Usage																
Plasticiser-Aggregate	3	5.3	2	0.8	5	1.6	1	0.9	1	0.8	3	4.4	3	0.8	6	1.4

Plasticiser-Other Element	2	3.5	11	4.3	13	4.2	2	2.9	11	3	13	3

Table 22. Plasticisers, divided by region, period, type, general adhesive class and general use.

	Region and Period																	
	Europe						Near East						Total					
	Mesolithic		Neolithic		Total		Late Epipaleolithic		Neolithic		Total		LE/ Mesolithic		Neolithic		Total	
	No	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**	**No**	**%**
Sites with Other Elements	3	*5.3*	23	*9.1*	26	*8.4*	1	*9.1*	13	*11.4*	14	*11.2*	4	*5.9*	36	*9.8*	40	*9.2*
Other Element Type																		
Animal Blood			1	*4*	1	*3.4*			1	*5.3*	1	*5*			2	*4.5*	2	*4.1*
Aquatic Products			1	*4*	1	*3.4*									1	*2.3*	1	*2.*
Clay Plaster									6	*31.6*	6	*30*			6	*13.6*	6	*12.2*
Conifer Resin			1	*4*	1	*3.4*									1	*2.3*	1	*2*
Dairy Products			7	*28*	7	*24.1*									7	*15.9*	7	*14.3*
Dung Plaster			3	*12*	3	*10.3*									3	*6.8*	3	*6.1*
Fir Resin	1	*25*			1	*3.4*							1	*20*			1	*2*
Fruit Gum	1	*25*			1	*3.4*							1	*20*			1	*2*
Gypsum Plaster									3	*15.8*	3	*15*			3	*6.8*	3	*6.1*
Lime Plaster							1	*100*	6	*31.6*	7	*35*	1	*20*	6	*13.6*	7	*14.3*
Mud Plaster									1	*5.3*	1	*5*			1	*2.3*	1	*2*
Pine Resin			2	*8*	2	*6.9*									2	*4.5*	2	*4.1*
Plant Oils			6	*24*	6	*20.7*									6	*13.6*	6	*12.2*
Plant Waxes			1	*4*	1	*3.4*									1	*2.3*	1	*2*
Propolis Resin	1	*25*			1	*3.4*							1	*20*			1	*2*

Sea Onion Latex									1	*5.3*	1	*5*			1	*2.3*	1	*2*
Styrax Resin									1	*5.3*	1	*5*			1	*2.3*	1	*2*
Unidentified Animal Glue	1	*25*	1	*4*	2	*6.9*							1	*20*	1	*2.3*	2	*4.1*
Unidentified Resin			1	*4*	1	*3.4*									1	*2.3*	1	*2*
Urine			1	*4*	1	*3.4*									1	*2.3*	1	*2*
	4	***100***	**25**	***100***	**29**	***100***	**1**	***100***	**19**	***100***	**20**	***100***	**5**	***100***	**44**	***100***	**49**	***100***
Number of Other Elements in Adhesive																		
1	2	*66.7*	21	*91.3*	23	*88.5*	1	*100*	13	*92.9*	14	*93.3*	3	*75*	34	*91.9*	37	*90.2*
2	1	*33.3*	2	*8.7*	3	*11.5*			1	*7.1*	1	*6.7*	1	*25*	3	*8.1*	4	*9.8*
	3	***100***	**23**	***100***	**26**	***100***	**1**	***100***	**14**	***100***	**15**	***100***	**4**	***100***	**37**	***100***	**41**	***100***
Other Element Inclusion by General Adhesive Class																		
Animal Glues			2	*8.3*	2	*7.4*			1	*7.1*	1	*6.7*			3	*7.9*	3	*7.1*
Beeswax			9	*37.5*	9	*33.3*									9	*23.7*	9	*21.4*
Bitumen																		
Plasters			4	*16.7*	4	*14.8*	1	*100*	13	*92.9*	14	*93.3*	1	*25*	17	*44.7*	18	*42.9*
Tars	1	*33.3*	3	*12.5*	4	*14.8*							1	*25*	3	*7.9*	4	*9.5*
Resins/Others	2	*66.7*	6	*25*	8	*29.6*							2	*50*	6	*15.8*	8	*19*

Unidentified																		
	3	***100***	**24**	***100***	**27**	***100***	**1**	***100***	**14**	***100***	**15**	***100***	**4**	***100***	**38**	***100***	**42**	***100***
Other Element Inclusion by General Adhesive Use																		
Application			8	*36.4*	8	*33.3*	1	*100*	10	*66.7*	11	*68.8*	1	*20*	18	*48.6*	19	*47.5*
Burning			1	*4.5*	1	*4.2*									1	*2.7*	1	*2.5*
Chewing																		
Gluing	3	*75*	2	*9.1*	3	*12.5*							3	*60*	2	*5.4*	3	*7.5*
Manufacture									5	*33.3*	5	*31.3*			5	*13.5*	5	*12.5*
Processing/Production																		
Unknown	1	*25*	11	*50*	12	*50*							1	*20*	11	*29.7*	12	*30*
	4	***100***	**22**	***100***	**24**	***100***	**1**	***100***	**15**	***100***	**16**	***100***	**5**	***100***	**37**	***100***	**40**	***100***
Sites with Additive Co-Usage																		
Other Element-Aggregate	1	*1.8*	2	*0.8*	3	*1*	1	*9.1*	12	*10.5*	13	*10.4*	2	*2.9*	14	*3.8*	16	*3.7*
Other Element-Plasticiser	2	*3.5*	11	*4.3*	13	*4.2*							2	*2.9*	11	*3*	13	*3*

Table 23. Other element use, divided by region, period, type, general adhesive class and general use.

A3: Experimental Risk Assessment

THE UNIVERSITY of York

GENERAL RISK ASSESSMENT FORM

Section 1: Assessment Overview

Assessment Reference Number:	Version Control	

Name of Assessor	Andy Needham		
Description of Area / Procedure / Task being assessed	The tasks include a suite of experimental archaeological replication of prehistoric technology and working procedures, including: Making and using stone tools, working around/with fire, making birch bark tar, sawing wooden hafts. All activities will be led and supervised by experienced members of the YEAR team. Activities will take place at the YEAR Centre (an on-campus facility, covered by security and other university services), an enclosed area of woodland on Campus west, adjacent to Wentworth college, with controlled access.		
Location	YEAR centre, Campus west behind Wentworth college. The exact map of the location can be found here: https://www.york.ac.uk/map/#locid746		

Section 2: Persons Affected

Who might be affected by this work?	1) University of York Staff 2) University of York students	**Are any vulnerable groups affected?** (delete ✓ as applicable)	Students with visible and invisible disabilities, allergies, and possible other injuries or conditions	**How many people are affected?** (delete ✓ as applicable)	c. 2

(delete ✓ as applicable)					

Section 3: Review

Date for Next Review of this Document	Date Document Reviewed	Reviewed by (print name)	Signature
	12/04/21	Andy Needham	Andy Needham
	14/03/22	Andy Needham	Andy Needham

Section 4: Risk Assessment

Risk Matrix

Hazard Severity Score		Likelihood		Probability / Severity	1	2	3
Negligible Injury or Damage	1	Unlikely	1	1	LOW	MEDIUM	MEDIUM
Minor Injury or Damage	2	May Happen	2	2	MEDIUM	MEDIUM	HIGH
Major Injury or Death	3	Almost Certain	3	3	MEDIUM	HIGH	HIGH

SITE RISKS							
No.	Description of Hazard	Hazard Score	Initial Likelihood Score	Initial Risk	Controls	Residual Likelihood Score	Residual Risk
1	**Natural hazards: lake** The site is directly adjacent to a lake, posing a risk of drowning. The water quality is unknown and may pose additional risks based on the	3	1	M	▪ The experiment will be limited to the dryland area of the YEAR Centre, significantly reducing the risk. The lake edge will be out of bounds ▪ Participants will be warned of the dangers of the lake and actively reminded to avoid the lake edge zone	1	L

	potential inclusion of contaminants. The lake bottom is composed of soft mud and the lake is of a variable depth, though generally shallow directly adjacent to the bank.						
2	**Slips, trips, falls at the same level/uneven ground** The site is wooded, with substantial leaf litter, exposed roots from trees, and an undulating surface that can be slippery when wet. The site has a high quantity of knapping waste, which can be very sharp, used for a wide range of activities	**2**	**2**	**M**	▪ Participants reminded of the risk of tripping over branches or slipping in inclement weather ▪ Participants briefed to wear footwear with a good grip and ankle support to limit the risk of slips and injury from flint knapping waste ▪ Participants reminded to exercise vigilance when sitting or kneeling due to sharp flint waste	**1**	**L**
3	**Road Safety** The route to YEAR Centre requires walking along the side of a very quiet road, generally reserved for use by Estates staff and university contractors travelling at typically very low speed. However, this does pose the risk of injury from road traffic.	**3**	**1**	**M**	▪ Participants reminded of the need for good road safety whilst navigating this part of the route to the YEAR Centre ▪ Participants to walk to the side of the road and be vigilant for traffic ▪ Participants to move to the grass verge as vehicles pass	**1**	**L**

ACTIVITY RISKS							
No.	**Description of Hazard**	**Hazard Score**	**Initial Likelihood Score**	**Initial Risk**	**Controls**	**Residual Likelihood Score**	**Residual Risk**
4	**Heavy lifting** Experimental materials can be heavy and pose a risk of injury due to lifting heavy objects above personal capacity or incorrect lifting. Transporting materials from the PalaeoHub can pose a risk due to carrying over long distances.	**2**	**1**	**M**	▪ Participants reminded to only lift or carry to their own their capacity ▪ Wheelbarrow to be used to transport equipment and materials from/to the PalaeoHub or heavy items across to the YEAR centre by members of the YEAR team ahead of the workshop	**1**	**L**
5	**Making / working with fire** There is a risk of minor and perhaps more significant burns sustained during the process of starting and subsequently maintaining and fuelling small open wood fires for a number of hours. Typical configuration is a 15-25cm radius fire, fuelled by wood, with a slightly sunken pit base and channel, used for warmth,	**2/3**	**2**	**M**	▪ The Project will be supervised by experienced YEAR staff, all of whom are familiar with making and working with fire. ▪ Students will be briefed about fire safety ▪ First aid kit will be on site at all times and contains burns dressings ▪ Containers of water on site to extinguish fires ▪ Fire bucket and sand on site to extinguish fires ▪ Tongs available to move things in and out of the fire ▪ Heat safety gloves available in conjunction with tongs	**1**	**L**

	but also to heating materials where this is needed for experiments (so relevant entries below)				▪ All YEAR staff will carry charged mobile phones in the event of a serious injury		
6	**Making birch bark tar** Birch bark will be added to a metal can, a second can positioned below it and a small fire lit around the can to extra the tar. The risks primarily come from working with fire but also manipulating hot/warm tar	**2/3**	**2**	**M**	▪ The Project will be supervised by experienced YEAR staff, all of whom are familiar with making and working with fire. ▪ Students will be briefed about fire safety ▪ First aid kit will be on site at all times and contains burns dressings ▪ Containers of water on site to extinguish fires ▪ Fire bucket and sand on site to extinguish fires ▪ Tongs available to move things in and out of the fire ▪ Heat safety gloves available in conjunction with tongs ▪ All YEAR staff will carry charged mobile phones in the event of a serious injury	**1**	**L**
7	**Making stone tools** There is a risk of sustaining minor lacerations and bruises when making stone tools via knapping. Small flint chips can detach during knapping and there is the remote chance these can enter the eyes, causing injury.	**2**	**2**	**M**	▪ Students briefed about safe knapping technique by experienced YEAR team member before they start knapping ▪ All flint knapping will be supervised by an experienced member of the YEAR team while they knap ▪ Participants required to wear gloves during flint knapping, significantly reducing the risk of lacerations ▪ Participants required to wear protective glasses / goggles while flint knapping, or observing flint knapping, significantly reducing the risk of flint chips entering the eyes	**1**	**L**

				▪ Participants encouraged to use a thick protective piece of material (e.g. animal hide) to cover the legs / anchor the core/flake to absorb shock, avoid slips, protect from bruising, and limit the risk of lacerations ▪ A first aid kit will be on site at all times ▪ All YEAR staff will carry charged mobile phones in the event of a serious injury		
8	**Working with stone tools** Injury from using flint to cut, drill, scrape, clean, or otherwise process a range of materials, including animal parts (bone, hide), wood, plants, and soft stone	**2**	**2**	**M**	▪ Participants will be briefed about the risks of using sharp flint and hygiene hazards associated with handling a wide range of natural materials ▪ Participants encouraged to wear gloves for both safety and hygiene during experiments ▪ Participants encouraged to wash hands with antiseptic handwash, and water at the end of each session of work and during breaks before eating or drinking ▪ Environment building / PalaeoHub / Wentworth is a short walk away and can also be used for washing hands ▪ All YEAR staff will carry charged mobile phones in the event of a serious injury	**1**	**L**

9	**Working with metal tools** Injury from using saws to cut/process a variety of materials, including animal hide and wooden poles, for experiments.	**2**	**2**	**M**	▪ Participants will be briefed about the risks of using saws and hygiene hazards associated with handling a wide range of natural materials ▪ Participants encouraged to wear gloves for both safety and hygiene during experiments ▪ Participants encouraged to wash hands with antiseptic handwash, and water at the end of each session of work and during breaks before eating or drinking ▪ Environment building / PalaeoHub / Wentworth is a short walk away and can also be used for washing hands ▪ All YEAR staff will carry charged mobile phones in the event of a serious injury	**1**	**L**
1 0	**Dust/fibres/fumes produced from working with natural materials (stone, bone, antler, wood, plants, hides)** Working with natural materials can create fine dust or fibre residue, all of which can pose a risk over the very long term, or in very high quantities over shorter periods when inhaled. Toxic fumes can also be generated from the burning of certain materials during the course	**3**	**1**	**M**	▪ Experiments will be conducted outside, providing ample ventilation, effectively eliminating the risk ▪ All exposure levels will be significantly below dangerous levels, as defined by the HSE ▪ Face coverings worn to avoid COVID will further reduce risk.	**1**	**L**

	of experiments. Risk of inhalation is increased in non-ventilated areas when working indoors.						
11	**Materials to make glues: lime plaster** - can pose significant risk to health if ingested, or contacts the eyes, - can pose a more modest risk to health if it contacts the skin	**2**	**1**	**M**	▪ CoSHH completed and submitted to DSA for scrutiny, all team members aware of CoSHH assessment details and will abide by the safety procedures detailed therein ▪ in summary: wear gloves, wear goggles with coverage to front and sides, work in calm conditions, work with small quantities, follow all manufacturer recommendation for safe handling and use	**1**	**L**
12	**Material to make glues: birch bark tar** - possible carcinogen (long term exposure) - processing of the extracted tar will be carried out in a metal tin, close to but not in the fire, to thicken it. Hot tar can pose a risk	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ exposure time is short ▪ wear mask ▪ work with small quantities ▪ see entry 6 for further details. Wear gloves, use metal tongs to manipulate objection into / out of fire ▪ first aid kit and burns kit available in the shed ▪ first raiders available at Wentworth ▪ will carry charged mobile phones to call for ad in the event of injury	**1**	**L**

13	**Material to make glues: pine resin** - rarely can cause an allergic response	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ work with small quantities	**1**	**L**
14	**Material to make glues: bitumen** - carcinogen, releases hydrogen sulfide when heated	**2**	**1**	**M**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ exposure time is short, quantities very small ▪ wear mask ▪ work with small quantities	**1**	**L**
15	**Material to make glues: hide** - material poses no specific risks, but animal ethics a consideration	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ adhere to university animal ethics policy (see entry 33) ▪ work with small quantities	**1**	**L**
16	**Material to make glues: deer bone** - material poses no specific risks, but animal ethics a consideration. Hydrochloric acid to be used to leach collagen from the bones	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ adhere to university animal ethics policy (see entry 33) ▪ work with small quantities ▪ follow the product COSHH - gloves, goggles, use in a ventilated area, in keeping with the protocols above	**1**	**L**
17	**Material to make glues: chios mastic** - no specific risks identified	**1**	**1**	**L**	▪ adopt standard protocols: ▪ work outdoors in a well ventilated area	**1**	**L**

					▪ wear gloves ▪ wear mask ▪ work with small quantities		
18	**Material to make glues: amber** - no specific risks identified	**1**	**1**	**L**	▪ adopt standard protocols: ▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ work with small quantities	**1**	**L**
19	**Material to make glues: gum arabic** - no specific risks identified	**1**	**1**	**L**	▪ adopt standard protocols: ▪ work outdoors in a well ventilated area ▪ wear gloves ▪ work with small quantities ▪ wear mask	**1**	**L**
20	**Material to make glues: fish blood glue** - material poses no specific risks beyond basic hygiene, but animal ethics a consideration	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ adhere to university animal ethics policy (see entry 33) ▪ work with small quantities	**1**	**L**
21	**Material to make glues: pine bark tar** - possible carcinogen (long term exposure)	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ exposure time is short ▪ wear mask ▪ work with small quantities	**1**	**L**

22	**Material to make glues: nettle latex** - no specific risks identified. Latex a possible allergen	**1**	**1**	**L**	▪ adopt standard protocols: ▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ work with small quantities	**1**	**L**
23	**Material to make glues: cherry gum** - toxic when consumed	**2**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ work with small quantities, avoid consumption	**1**	**L**
24	**Material to make glues: Labdanum** - can be an allergen	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ work with small quantities	**1**	**L**
25	**Material to make glues: spruce resin** - no specific risks identified.	**1**	**1**	**L**	▪ adopt standard protocols: ▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ work with small quantities	**1**	**L**
26	**Material to make glues: Myrrh** - can be an allergen	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ work with small quantities	**1**	**L**

No.	Description of Hazard	Hazard Score	Initial Likelihood Score	Initial Risk	Controls	Residual Likelihood Score	Residual Risk
27	**Material to make glues: Gum Tragacanth and Galbanum / Asafoetida** - no specific risks identified.	**1**	**1**	**L**	▪ adopt standard protocols: ▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ work with small quantities	**1**	**L**
28	**Material to make glues: fish skin glue** - material poses no specific risks beyond basic hygiene, but animal ethics a consideration	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ adhere to university animal ethics policy (see entry 33) ▪ work with small quantities	**1**	**L**
29	**Material to make glues: beeswax** - very rarely can be an allergen - animal ethics a consideration	**1**	**1**	**L**	▪ work outdoors in a well ventilated area ▪ wear gloves ▪ wear mask ▪ adhere to university animal ethics policy (see entry 33) ▪ work with small quantities	**1**	**L**
ENVIRONMENTAL RISKS							
No.	**Description of Hazard**	**Hazard Score**	**Initial Likelihood Score**	**Initial Risk**	**Controls**	**Residual Likelihood Score**	**Residual Risk**
30	**Working in inclement weather (including lightning)**	**3**	**1**	**M**	▪ All participants briefed to carry waterproof clothing	**1**	**L**

	The experiment is being conducted in autumn, with cool and rainy days expected, and with potential for variable conditions. Whilst thunderstorms are not forecast, this is a possibility and can pose a risk during outdoor working in a forested environment, both from direct strikes, but also from falling trees.				▪ All participants briefed to wear sensible footwear with a good grip ▪ All participants briefed to potentially carry warmer clothing in anticipation of poor weather ▪ In the event of sustained poor weather, Wentworth and/or PalaeoHub will can be used as shelter until the weather improves ▪ The site is covered by extensive tree canopy, reducing the risk of extremes of sun exposure, such as sun burn or sunstroke, but participants will be briefed to exercise usual precautions, including sun cream, plenty of fresh drinking water, and to seek shade and take regular breaks ▪ Shelters will be erected to limit the risks of getting excessively wet during heavy rain, in combination with appropriate water resistant clothing. ▪ PalaeoHub is available to replenish drinking water as needed for all participants ▪ outdoor work will cease during a thunder storm if nearby and move to the PalaeoHub for the duration		
31	**Local fauna and flora** The site is home to diverse flora and fauna, typical of British woodland. The site is routinely	**2**	**2**	**M**	▪ Consumption of local flora strictly prohibited ▪ Contact with local fauna strictly prohibited	**1**	**L**

	visited by birds (especially small water birds from the lake) and small mammals. Some animals may carry the potential risk of harbouring disease, some of which may be deleterious to human health. Flora is diverse but includes leafy plants and fungus, at least some of which can be deleterious to human health if consumed.						
32	**COVID 19** Experiments will take place during a global pandemic. Covid 19 can spread by close contact and may survive on surfaces.	**3**	**2**	**H**	▪ Participants required to wear face coverings while at the YEAR Centre ▪ Participants required to socially distance while at the YEAR Centre ▪ Participants issued with PPE (gloves, goggles) ▪ Participants encouraged to wash hands frequently (e.g. if using the bathroom and returning to the site) ▪ the YEAR Centre is an open-air facility and will be very well ventilated ▪ in the event we move to indoor working, classrooms are set out for social distancing and with controls for ventilation	**2**	**M**
PARTICIPANT RISKS							

No.	Description of Hazard	Hazard Score	Initial Likelihood Score	Initial Risk	Controls	Residual Likelihood Score	Residual Risk
33	**Visible and invisible disabilities, allergies, dietary intolerances, phobias, or other pre-existing injuries or conditions which may affect safe working** Student participants may have any combination of the aforementioned, which may change the risk profile associated with any and all activities, the location, or the environment, for that specific student, without accommodation for the condition(s) in question.	**2**	**2**	**M**	▪ Students encouraged to discuss with the module leader (Andy Needham) any conditions that they feel may be relevant to any aspect of the workshop in advance of the activity or activities about which they are concerned. Students can email Andy Needham in advance (andrew.needham@york.ac.uk) and/or speak to him directly. Accommodations or alternatives can be explored, linked to the specific nature of the condition, to reduce risk whilst maximising participation	**1**	**L**

OTHER

No.	Description of Hazard	Hazard Score	Initial Likelihood Score	Initial Risk	Controls	Residual Likelihood Score	Residual Risk

34	**Hygiene arrangements** All experiments will be carried out in an area of woodland, using natural materials. There is a risk of contact with or ingestion of substances deleterious to health unless good hygiene is practiced.	**2**	**2**	**L**	▪ Bathrooms / handwashing facilities are available in PalaeoHub / Wentworth / Environment, a few minutes walk away from site ▪ Alcohol hand wash gel will be available directly on site to supplement handwashing ▪ Gloves will be available and encouraged to be used for all experiments ▪ Alcohol wipes available in the first aid kit to clean minor wounds	**1**	**L**
35	**Animal ethics** Animal parts may be used as part of experiments (e.g. antler tools for working flint), raising the risk of animal treatment in sourcing these materials	**N/A**	**N/A**	**N/A**	▪ All research conducted involving animals is in accordance with the Animals (Scientific Procedures) Act 1986 (https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/291350/Guidance_on_the_Operation_of_ASPA.pdf). None of the animals are protected and have not been killed for the purpose of this research. All animals were pre-killed by license holders using the appropriate methods of killing as outlined in Appendix D of the above Act.	**N/A**	**N/A**
36	**Emergency procedure** In the event of an injury necessitating first aid, or a major injury requiring the emergency services.	**N/A**	**N/A**	**N/A**	▪ Staff members will have a charged mobile phone to call the emergency services and/or security in the event of a serious incident ▪ First aid kit on site at all times	**N/A**	**N/A**

	In the event of a fire that is out of control and cannot be extinguished via the measures identified above.				▪ First aiders on hand at Environment (Matt von Tersch), PalaeoHub (Becky Knight), and Wentworth ▪ 01904 32 3333 will be dialled for campus security first response in the event of an emergency. Phone signal is readily available at the YEAR Centre ▪ 999 will be dialled if a major injury is sustained for rapid expert treatment. The site is readily accessible. Phone signal is readily available at the YEAR Centre ▪ 999 will be dialled if a fire is out of control. The site is readily accessible. Phone signal is readily available at the YEAR Centre		

Section 5: Assessment Sign-Off

Assessor's Signature	*Andy Needham*	Position	**BA Research Fellow**
Print Name	**Andy Needham**	Date	**25/03/2021**
Additional Comments			

Assessment Agreed by	*Gareth Perry*	Position	**DSA**

Print Name	Gareth Perry	Date and Time	25/03/2021
Additional Comments			

Section 6: Communication of Risk Assessment

Please register your response in the Google Form to acknowledge that you have read and understood the risk assessment and agree to comply with the safety guidelines set out.

Table 24. Experimental risk assessment.

A4: COSHH Risk Assessment

COSHH Risk Assessment

UNIVERSITY of York

Section/Area: Archaeology, PalaeoHub / YEAR Centre	Faculty:
Name the substance involved in the process and its manufacturer. *(A copy of a current safety data sheet for this substance should be attached to this assessment)*	Calcium hydroxide Produced by: APC Pure MSDS by: Atom Scientific Ltd.
Describe the activity or work process. *(Include: how long and how often this is carried out, the quantity of substance used, whether dilution is required and the substance type e.g. liquid, solid, dust, fume, mist, gas etc.)*	A small quantity of the powdered calcium hydroxide will be mixed with water to create a paste. This paste will be applied to a wooden haft, a stone tool inserted, and the mixture left to set. The efficacy of the substance as a glue will be assessed through use of the tool.
Location of process being carried out?	YEAR Centre (controlled outdoor laboratory working space, 2 minutes walk from Phub and Wentworth college)

Identify the persons /environment at risk:	Natural Environment	☐	Employees *(including trainees)*	X	Contractors	☐	Public *(including students)*	☐

Risk Phrases & Hazard Identification *(record risk phrases below and click all relevant boxes to record a X in the box)*

Causes skin irritation. Causes serious eye damage. May cause respiratory irritation.

Classification *(state the category of danger)*

☐	Toxic / Biohazard /Carcinogen	☐	Serious health hazard	☐	Danger to Environment * Aquatics, plants, animals
X	Harmful / Irritant / Sensitising	☐	Extremely Flammable/Flammable	☐	Explosive

X Corrosive ☐ Oxidising ☐ Gas under pressure

Route of Exposure

X	X	X	X	☐
Inhalation	Skin	Eyes	Ingestion	Other (state)

If other please state: Click here to enter text.

Workplace Exposure Limits (WELs) *please indicate n/a where not applicable*

Long-term exposure level (8hr TWA):	Short-term exposure level (15 mins):
5 mg/m3	**No specific limits noted in the MSDS**

Briefly summarise any specific activities where the material will present a risk e.g. decanting, spraying, spills

Material will be handled during decanting, mixing, and application to wooden haft, initially in a powdered form, and then in the form of a slurry (water added to powder). Material will be handled in a solidified form as part of the mastic for the haft during use. Quantities used will be small (c. teaspoon – tablespoon of powder).

Control Measures: *(for example extraction, ventilation, training, supervision). Include special measures for vulnerable groups, such as disabled people and pregnant workers)* Consider all activities listed above.

- work will be supervised by experienced experimental archaeology practitioner (Dr Andy Needham)
- gloves (nitrile) worn at all times
- eye protection (Perspex goggles) at all times
- hygienic working (wash hand at the end of each phase of work or when takin breaks, avoid contact with eyes and face during working periods)
- masks will be worn at all times (largely for COVID, but this will act as added protection from dust)
- outdoor working

Is health surveillance or monitoring required?	Yes ☐	No X	
Personal Protective Equipment *(*state type and standard, click as appropriate x)* * Please note this is not an exhaustive list			
Respirator	☐ BS EN 136 Full mask ☐ BS EN 140 Half mask ☐ BS EN 405 Disposable half mask	Goggles	X BS EN 166:2001
Gloves	X BS EN 374-3 Resistance to chemical hazards	Overalls	☐ BS EN 340:2003 (single use)
Footwear	☐ BS EN 20345:2011	Other	Click here to enter text.
Dust mask	X BS EN 149:20-01 ☐ FFP 1 ☐ FFP 2 ☐ FFP 3		Click here to enter text.

First Aid Measures

Ingestion: Never give anything by mouth to an unconscious person. Wash out mouth with water. Consult a doctor

Skin Contact: Wash immediately with plenty of soap and water. Consult a doctor.

Eyes Contact: Bathe the eye with running water for 15 minutes. Consult a doctor.

Inhalation: Move to fresh air in case of accidental inhalation of vapours. If unconscious, check for breathing and apply artificial respiration if necessary. Consult a doctor.

Safe Storage

Handling: Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.

Storage conditions: Store in cool, well ventilated area. Keep container tightly closed.

Packaging: n/a

Management of Spills

MSDS: n/a

Fire Fighting

Extinguishers: Water spray. Alcohol resistant foam. Dry chemical powder. Carbon dioxide.

Fire fighters: Wear self-contained breathing apparatus.

Disposal of Substances & Contaminated Containers

Hazardous Waste	☐	General waste/Skip	☐	Return to Supplier	☐	Other	X

If Other Please State:

MSDS states: Offer surplus and non-recyclable solutions to a licensed disposal company. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

IF IN DOUBT CONTACT THE ENVIRONMENTAL MANAGER

Is exposure adequately controlled? Yes X No ☐

What further action needs to be taken		
Action	By who	By what date

Assessed by:	Andy Needham	Initial Date created	30/03/21

Table 25. COSHH assessment for lime plaster working.

A5: Experimental Tool Measurements

Adhesive	Tool Height	Tool Width	Tool Depth	Haft Height	Haft Width	Haft Depth
Acacia Gum (Plain)	7cm	3.2cm	1.1cm	15.7cm	1.4cm	1.4cm
Acacia Gum (Compound)	7.9cm	2.8cm	1cm	15.2cm	1.7cm	1.6cm
Asafoetida (Plain)	8cm	3cm	1.1cm	15.2cm	1.3cm	1.5cm
Asafoetida (Compound)	6.6cm	3.7cm	1.1cm	16.5cm	1.5cm	1.4cm
Beeswax (Plain)	8cm	3cm	1cm	18cm	1.8cm	1.8cm
Beeswax (Compound)	9cm	3.1cm	0.9cm	14.8cm	1.9cm	1.8cm
Birch Bark Tar (Plain)	8.4cm	3cm	1.1cm	16cm	1.8cm	1.9cm
Birch Bark Tar (Compound)	8.6cm	3.6cm	1cm	16.2cm	1.7cm	1.7cm
Bitumen (Plain)	9.3cm	3.4cm	0.9cm	14.6cm	1.9cm	1.6cm
Bitumen (Compound)	8.7cm	3.1cm	1cm	16cm	1.7cm	1.8cm
Cherry Gum (Plain)	8.3cm	3.7cm	1.4cm	14.9cm	1.1cm	1.3cm
Cherry Gum (Compound)	7.3cm	3.9cm	1.6cm	14.9cm	1.7cm	1.5cm

Chios Mastic (Plain)	7.6cm	4.3cm	1.3cm	15.3cm	1.3cm	1.2cm
Chios Mastic (Compound)	9.5cm	3.1cm	1.2cm	15.2cm	1.8cm	1.9cm
Cow Blood (Plain)	9.5cm	3.5cm	1.1cm	15cm	1.3cm	1.2cm
Cow Blood (Compound)	9cm	3.6cm	1cm	16.1cm	1.4cm	1.4cm
Deer Bone (Plain)	7.5cm	3.5cm	1.3cm	15.3cm	1.3cm	1.3cm
Deer Bone (Compound)	9cm	4.1cm	1.5cm	16.6cm	1.3cm	1.3cm
Deer Hide (Plain)	8.5cm	3.5cm	1.2cm	15.6cm	1.7cm	1.5cm
Deer Hide (Compound)	8cm	3.6cm	1.2cm	15.3cm	1.8cm	1.8cm
Egg White (Plain)	6.9cm	3.7cm	1.2cm	14.3cm	1.3cm	1.2cm
Egg White (Compound)	5.5cm	4.4cm	1.2cm	15.3cm	1.7cm	1.8cm
Frankincense (Plain)	9.1cm	3.2cm	0.8cm	16.1cm	1.6cm	1.7cm
Frankincense (Compound)	8.6cm	4.1cm	1.4cm	15.8cm	1.7cm	1.8cm

Gum Tragacanth (Plain)	8.4cm	3.2cm	1.4cm	14.9cm	1.2cm	1.3cm
Gum Tragacanth (Compound)	6.6cm	3.2cm	1cm	15cm	1.3cm	1.6cm
Labdanum (Plain)	8.5cm	3.7cm	1.1cm	15.7cm	1.4cm	1.3cm
Labdanum (Compound)	7.7cm	3.4cm	1.3cm	14.9cm	1.6cm	1.6cm
Lime Plaster (Plain)	8.9cm	3.4cm	0.7cm	15.1cm	1.7cm	1.7cm
Lime Plaster (Compound)	8.9cm	3.8cm	1cm	15.4cm	1.5cm	1.5cm
Milk Casein (Plain)	7.4cm	4.2cm	1.2cm	14.7cm	1.8cm	1.5cm
Milk Casein (Compound)	8.2cm	4cm	1.4cm	18.5cm	2.1cm	2cm
Myrrh (Plain)	6.9cm	4.7cm	1.5cm	14.2cm	1.7cm	1.8cm
Myrrh (Compound)	8.3cm	3.4cm	0.9cm	14.9cm	1.7cm	1.8cm
Nettle Latex (Plain)	6.2cm	3.1cm	0.5cm	15.3cm	1.6cm	1.8cm
Nettle Latex (Compound)	7.8cm	3.6cm	1.8cm	15.5cm	1.3cm	1.4cm
Pine Bark Tar (Plain)	8.7cm	4.5cm	1.6cm	15.3cm	1.8cm	1.7cm

Pine Bark Tar (Compound)	8.3cm	3.5cm	1.1cm	15.2cm	1.5cm	1.5cm
Pine Resin (Plain)	8.1cm	3.5cm	0.9cm	15.4cm	2cm	2cm
Pine Resin (Compound)	8.7cm	3.8cm	0.8cm	17.3cm	1.5cm	1.5cm
Sandarac (Plain)	8.7cm	2.3cm	0.5cm	15.1cm	1.4cm	1.3cm
Sandarac (Compound)	8.1cm	2.9cm	0.6cm	15.5cm	1.5cm	1.6cm
Spruce Resin (Plain)	8cm	3.4cm	0.9cm	15.6cm	2cm	1.9cm
Spruce Resin (Compound)	7.9cm	2.3cm	1.3cm	14.8cm	1.6cm	1.5cm
Trout Bone (Plain)	7cm	4.2cm	1cm	15.3cm	1.3cm	1.2cm
Trout Bone (Compound)	7.8cm	4cm	1.5cm	15.5cm	1.2cm	1.3cm
Trout Skin (Plain)	8.6cm	3.3cm	0.9cm	15.1cm	1.6cm	1.5cm
Trout Skin (Compound)	9.4cm	3.6cm	1.2cm	15.3cm	1.5cm	1.5cm
Wheat Starch (Plain)	9.1cm	3.5cm	1.1cm	14.8cm	1.3cm	1.4cm
Wheat Starch (Compound)	9.8cm	3cm	1.3cm	15.1cm	1.5cm	1.7cm

Average Measurements	8.2cm	3.5cm	1.1cm	15.5cm	1.6cm	1.6cm

Table 26. Dimensions of tools hafted with plain and compound adhesives, measured at their mid points.

A6: Environmental Conditions during Adhesive Application

	Plain			Compound		
Adhesive	**Temperature**	**Humidity**	**Conditions**	**Temperature**	**Humidity**	**Conditions**
Acacia Gum	10.8°C	56%	Heavy Rain	8.8°C	88%	Rain
Asafoetida	14.4°C	57%	Cloud	12.2°C	60%	Cloud
Beeswax	14.2°C	30%	Cloud	17.4°C	36%	Cloud
Birch Bark Tar	19.2°C	54%	Part Cloud	18.9°C	55%	Part Cloud
Bitumen	10.5°C	47%	Sun	12.6°C	41%	Cloud
Cherry Gum	14.4°C	36%	Cloud	16.5°C	42%	Cloud
Chios Mastic	12.9°C	37%	Part Cloud	13.1°C	38%	Cloud
Cow Blood	11.6°C	68%	Part Cloud	11.7°C	68%	Part Cloud
Deer Bone	11°C	78%	Cloud	10.6°C	75%	Cloud
Deer Hide	10.1°C	50%	Sun	8.9°C	56%	Part Cloud
Egg White	10.1°C	77%	Part Cloud	10.3°C	80%	Part Cloud
Frankincense	14.7°C	53%	Part Cloud	14.5°C	51%	Part Cloud
Gum Tragacanth	12.4°C	46%	Part Cloud	15.2°C	38%	Part Cloud
Labdanum	10.1°C	76%	Cloud	10.8°C	79%	Cloud
Lime Plaster	19.8°C	20%	Cloud	15.6°C	22%	Cloud
Milk Casein	13.6°C	66%	Sun	14.2°C	67%	Sun
Myrrh	13.5°C	39%	Part Cloud	17.4°C	32%	Cloud
Nettle Latex	10°C	79%	Part Cloud	12.5°C	73%	Part Cloud
Pine Bark Tar	10.5°C	45%	Sun	8.5°C	50%	Sun
Pine Resin	12.9°C	40%	Cloud	13.2°C	40%	Cloud
Sandarac	10.5°C	51%	Part Cloud	10.1°C	48%	Part Cloud

Spruce Resin	9.2°C	49%	Part Cloud	9.5°C	52%	Part Cloud
Trout Bone	10.8°C	77%	Part Cloud	12.5°C	80%	Cloud
Trout Skin	6.4°C	38%	Cloud	6.7°C	36%	Cloud
Wheat Starch	9.2°C	81%	Cloud	9.5°C	84%	Cloud

Table 27. Temperature, humidity and weather conditions during experimental adhesive application to tools/cubes.

A7: Adhesive Working Properties and Appearance

	Plain		Compound	
Adhesive	**Appearance**	**Properties**	**Appearance**	**Properties**
Acacia Gum	Thin patchy layer of pale brown adhesive with air bubbles present	Water needed to liquify from a solid state	Layer of waxy black adhesive	Difficult to fully mix with additive content
Asafoetida	Thin patchy layer of pale grey adhesive. Unpleasant smell	Water needed to liquify from a solid state. Runny	Layer of matte black adhesive	
Beeswax	Layer of yellow waxy adhesive	Dried quickly, even on utensil used for application. Extremely runny	Layer of slightly granular waxy black adhesive	Dried quickly, even on utensil used for application. Extremely runny
Birch Bark Tar	Thin layer of glossy black adhesive	Somewhat runny	Layer of waxy black adhesive	Additive content made it runnier, but reduced drying time considerably
Bitumen	Thick layer of glossy black adhesive		Layer of matte black adhesive	
Cherry Gum	Layer of granular purple-black adhesive	Water needed to liquify from a solid state. Unadhesive until dried	Layer of granular black adhesive with small chunks of unabsorbed gum	Difficult to fully mix with additive content
Chios Mastic	Thick layer of beige adhesive. Fragrant smell	More viscous than conifer resins	Layer of smooth greenish-black adhesive. Fragrant smell	
Cow Blood	Thin layer of red-black adhesive. Strong smell	Extremely runny with long drying time	Layer of black waxy adhesive. Strong smell	Made runnier by additive content
Deer Bone	Thin patchy layer of pale grey adhesive	Runny	Layer of black adhesive	Made runnier by additive content

Deer Hide	Thin layer of glossy orange-brown adhesive	Runny	Thick layer of grey-black adhesive	Made runnier by additive content
Egg White	Thin layer of foam-like grey adhesive with dark grey flecks from ash	Limited adhesiveness until dried	Thin layer of foam-like dark grey adhesive with dark grey flecks from ash	Difficult to fully mix with additive content – temperature must be carefully regulated to avoid cooking the egg but prevent beeswax solidification
Frankincense	Thin layer of granular pale yellow adhesive. Fragrant smell	Could not fully melt frankincense granules beyond a certain point. Had to repeat a number of times due to poor adhesion	Thick layer of waxy black adhesive with small chunks of unabsorbed resin. Fragrant smell	Considerable improvement in working properties – it become liquid for easier application
Gum Tragacanth	Thin patchy layer of pale white-yellow adhesive with small chunks of unabsorbed gum	Water needed to liquify from a solid state	Thin patchy layer of black adhesive with small chunks of unabsorbed gum	Difficult to fully mix with additive content
Labdanum	Thick mouldable layer of matte greenish-black adhesive. Fragrant smell	Viscous	Thick mouldable layer of black adhesive. Fragrant smell	
Lime Plaster	Patchy layer of smooth white adhesive		Layer of heavily cracked grey adhesive	
Milk Casein	Thick layer of light grey adhesive with dark grey flecks from ash	Extremely viscous – had to be moulded in place	Thick layer of dark grey adhesive with dark grey flecks from ash	

Myrrh	Layer of brown-red granular adhesive. Fragrant smell	Unadhesive until dried	Layer of granular black adhesive. Fragrant smell	
Nettle Latex	Mouldable layer of brown adhesive. Strong smell	Extremely viscous. Prone to running if left for prolonged periods (upwards of 2 weeks)	Mouldable layer of granular black adhesive	Quicker to dry and lacking issues with adhesive running
Pine Bark Tar	Thick layer of dark brown adhesive	Somewhat runny	Layer of waxy brown adhesive	Addition of beeswax made tar runnier, but reduced drying time considerably
Pine Resin	Heavily cracked layer of glossy yellowish-orange adhesive		Layer of waxy matte greenish-black adhesive	Made runnier by additive content
Sandarac	Layer of pale orangish-brown adhesive	Extremely difficult to work – congealed into a solid mass requiring manual separation. Had to be repeated several times due to poor adhesion	Layer of brown-black adhesive	No substantial change in properties from plain. Difficult to incorporate additive content
Spruce Resin	Heavily cracked layer of glossy orange adhesive		Layer of waxy matte black adhesive.	Made runnier by additive content
Trout Bone	Thin patchy layer of pale brown adhesive	Runny	Thin layer of matte black adhesive.	Made runnier by additive content
Trout Skin	Thin layer of pale brown adhesive	Runny	Thin layer of granular dark grey adhesive.	Made runnier by additive content
Wheat Starch	Layer of matte white adhesive		Layer of matte black adhesive.	

Table 28. Adhesive working properties and appearance upon application to tools.

A8: Photographs of Hafted Tools

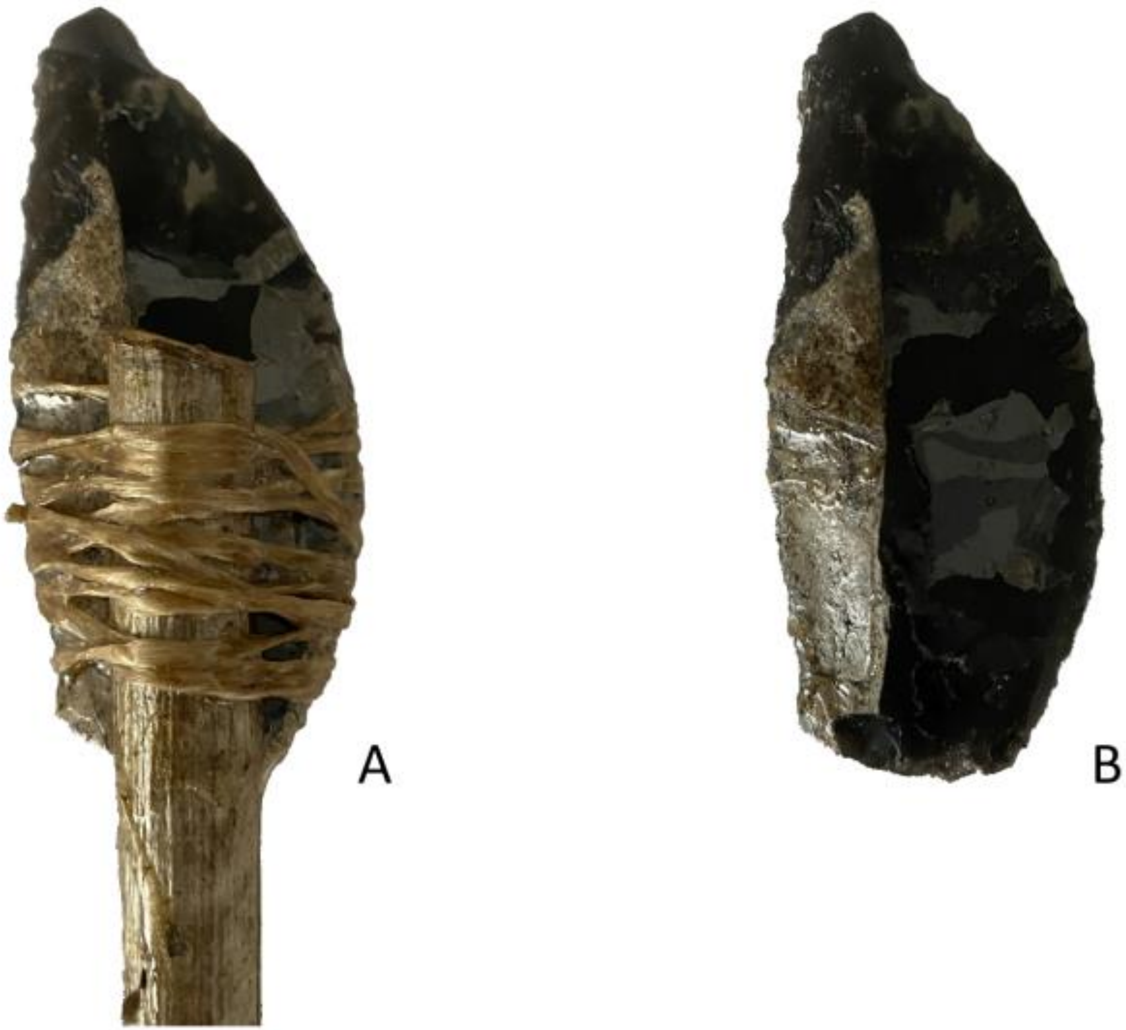


Figure 89. Plain acacia gum (A) before and (B) after testing.

Figure 90. Compound acacia gum (A) before and (B) after testing.

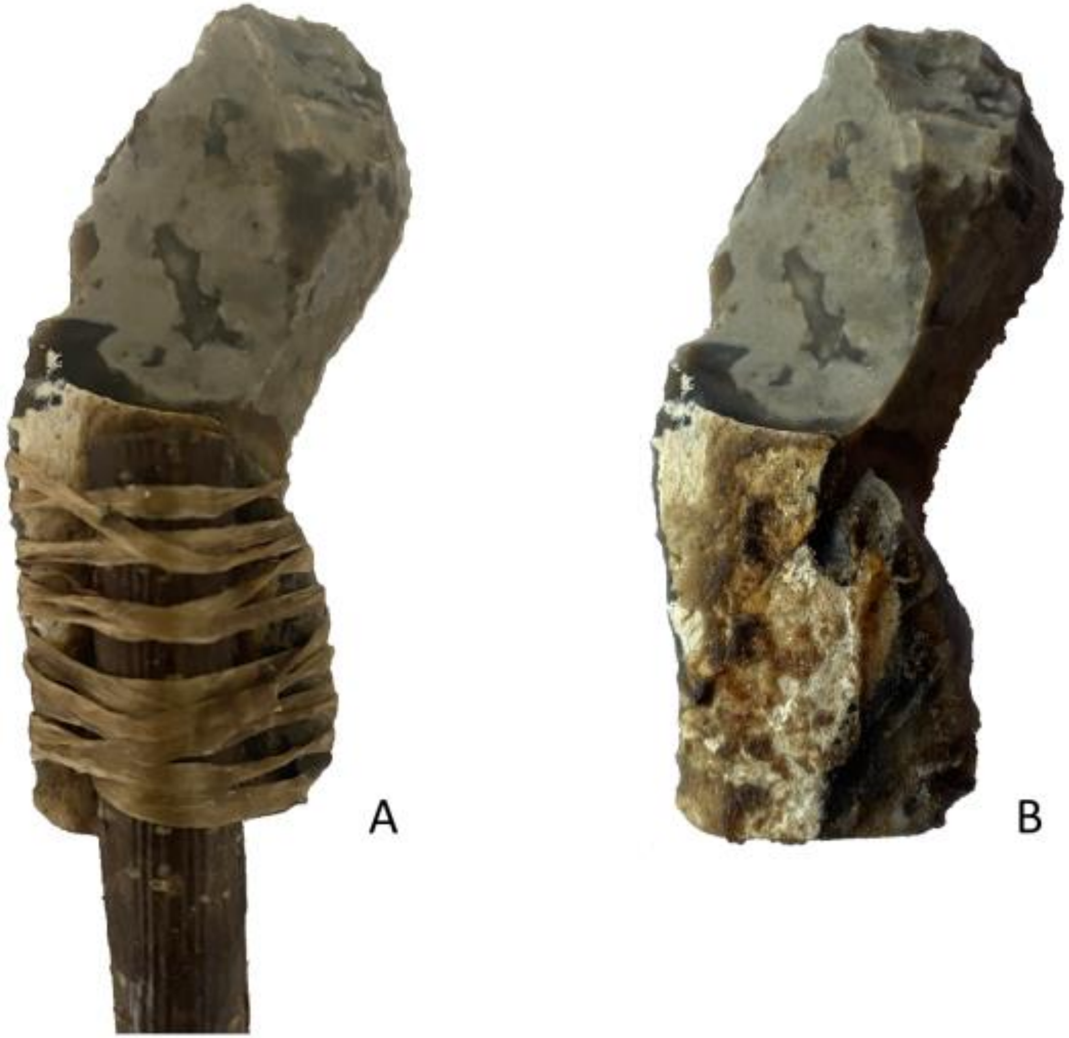


Figure 91. Plain asafoetida (A) before and (B) after testing.

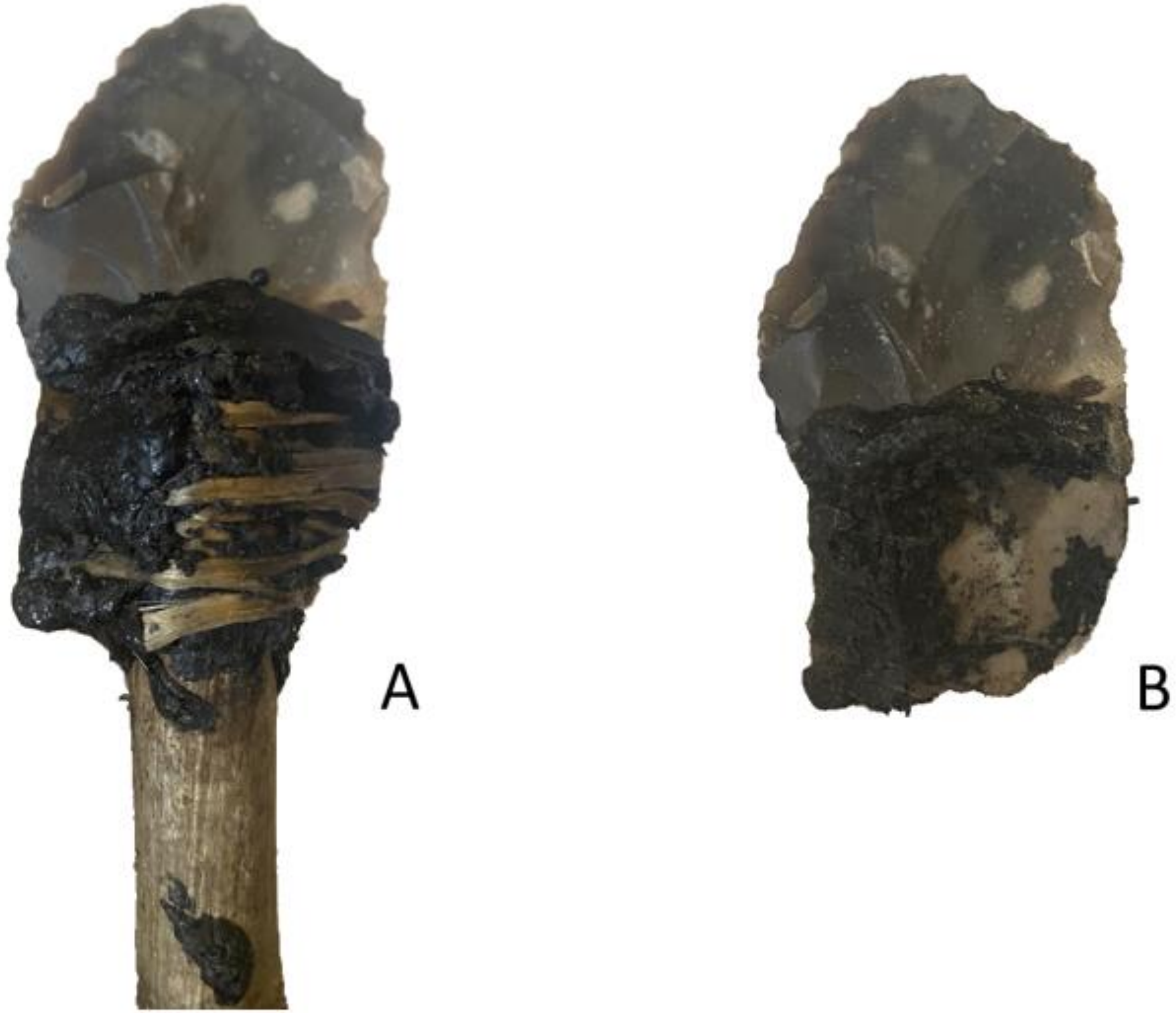


Figure 92. Compound asafoetida (A) before and (B) after testing.

Figure 93. Plain birch bark tar (A) before and (B) after testing.

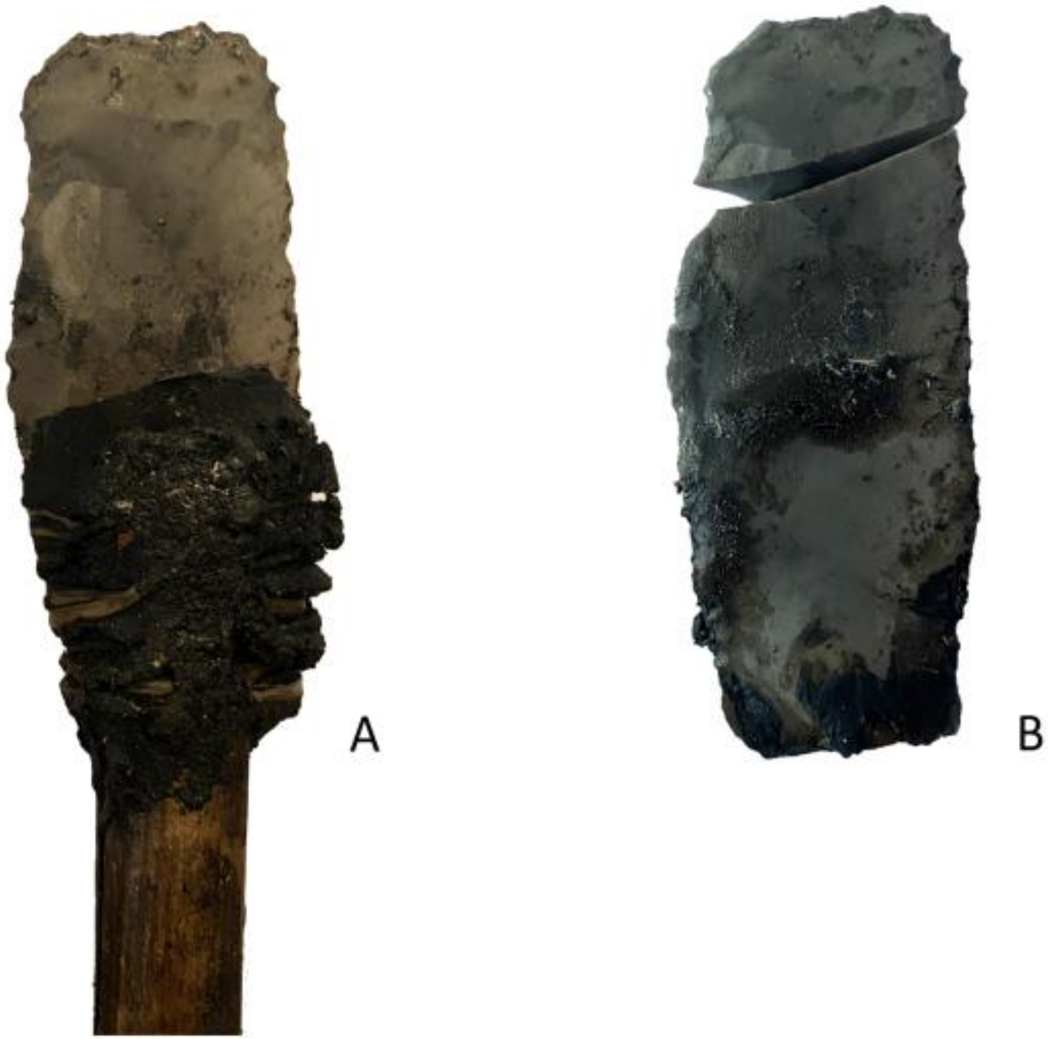


Figure 94. Compound birch bark tar (A) before and (B) after testing.

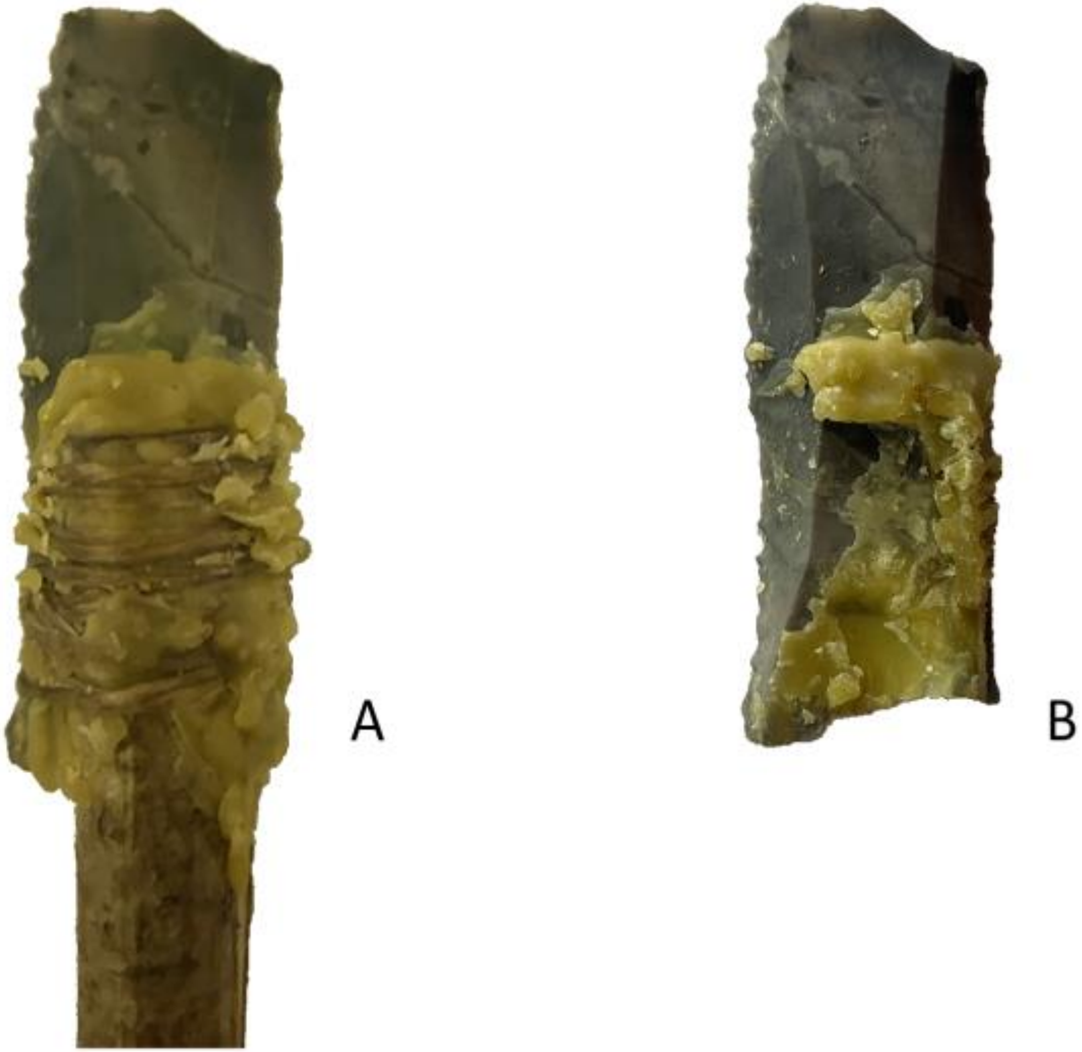


Figure 95. Plain beeswax (A) before and (B) after testing.

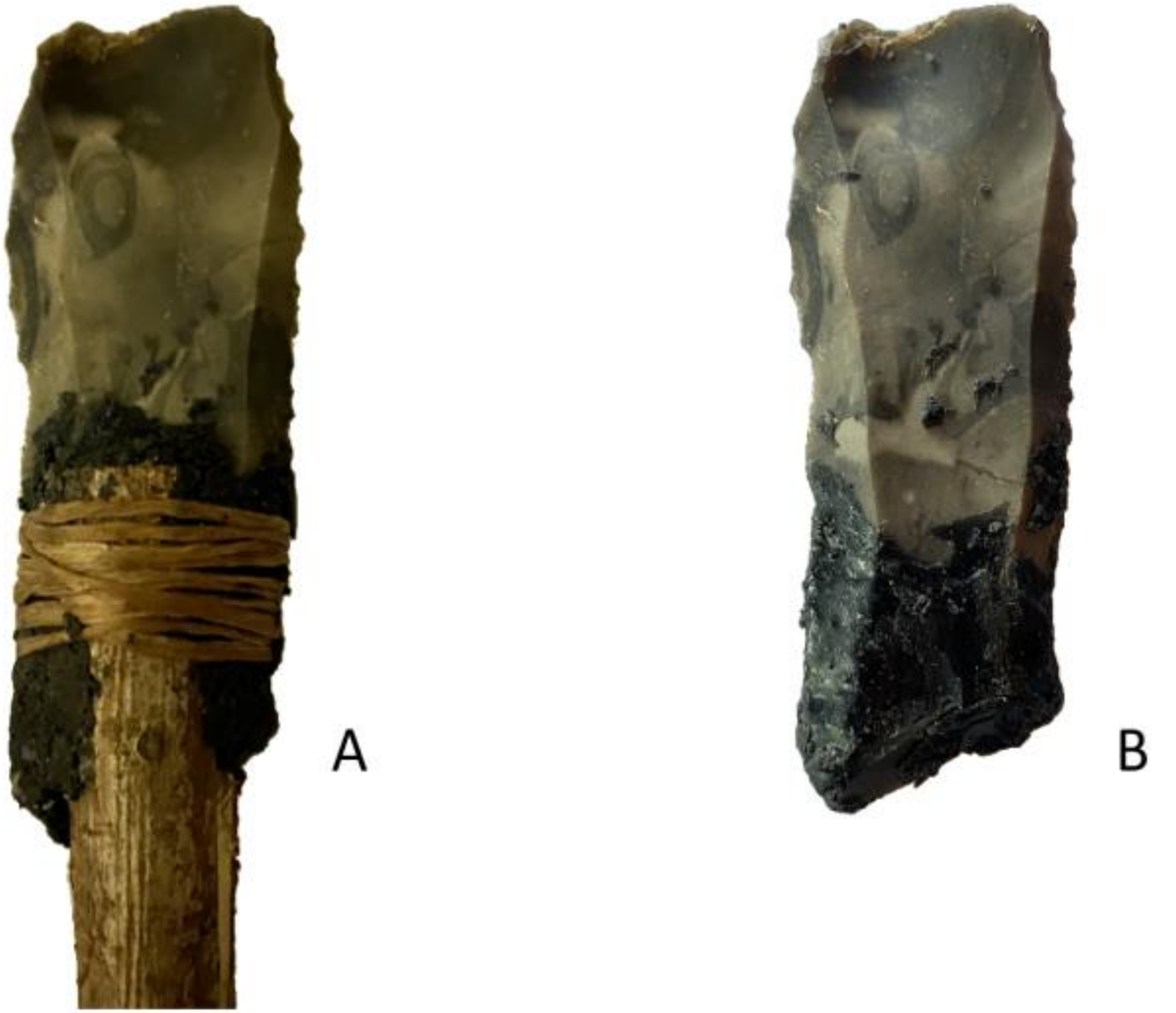


Figure 96. Compound beeswax (A) before and (B) after testing.

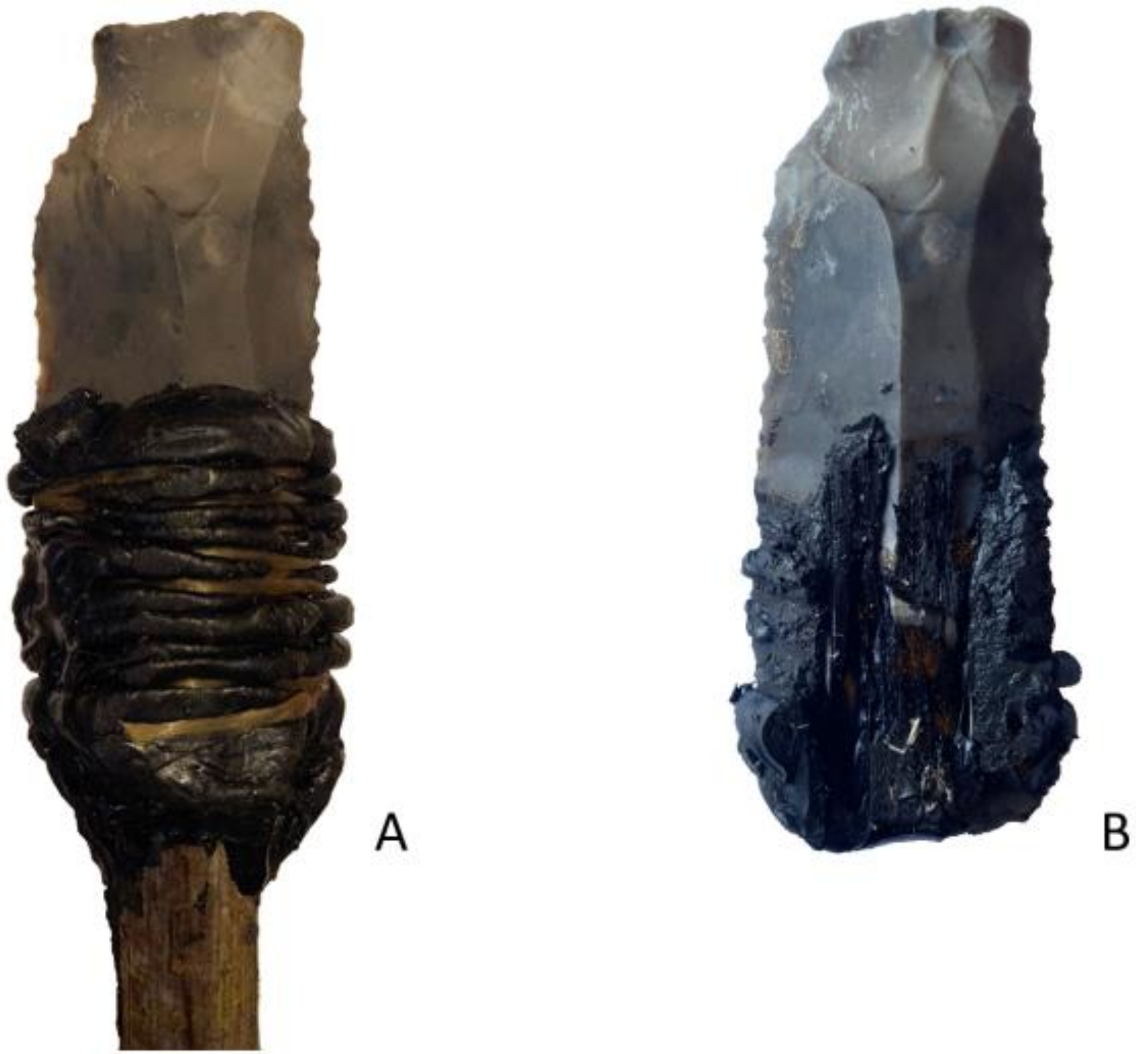


Figure 97. Plain bitumen (A) before and (B) after testing.

Figure 98. Compound bitumen (A) before and (B) after testing.

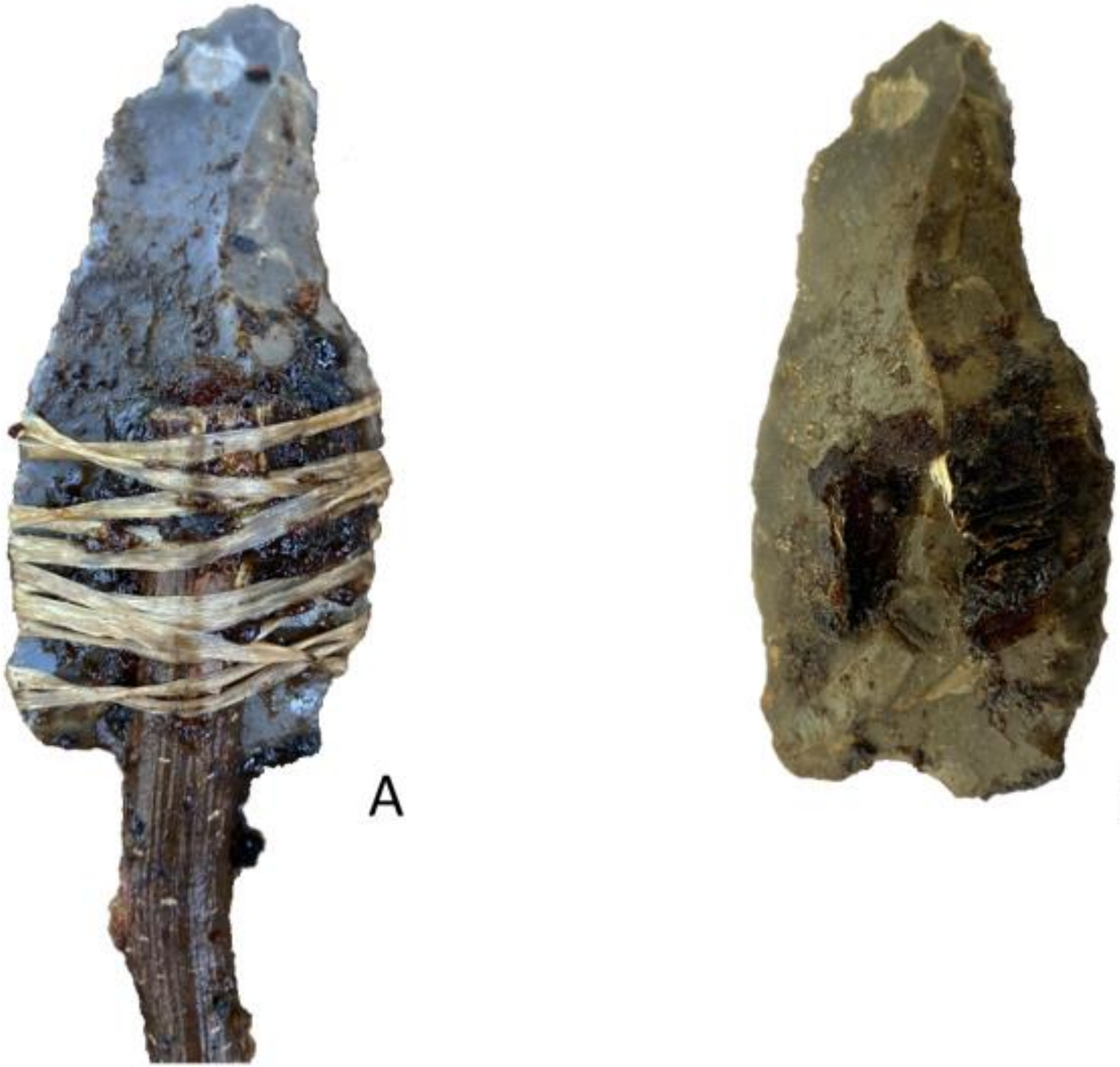


Figure 99. Plain cherry gum (A) before and (B) after testing.

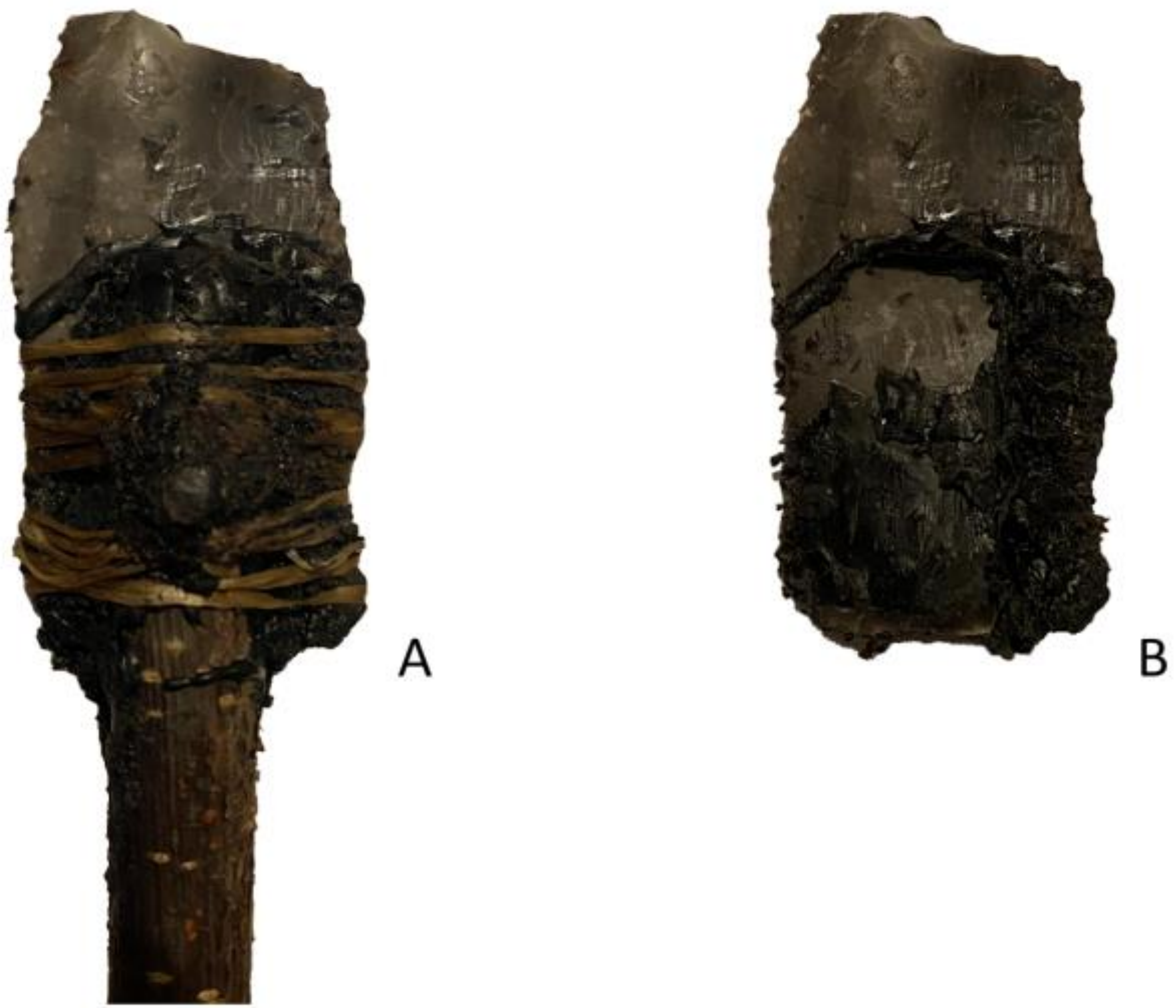


Figure 100. Compound cherry gum (A) before and (B) after testing.

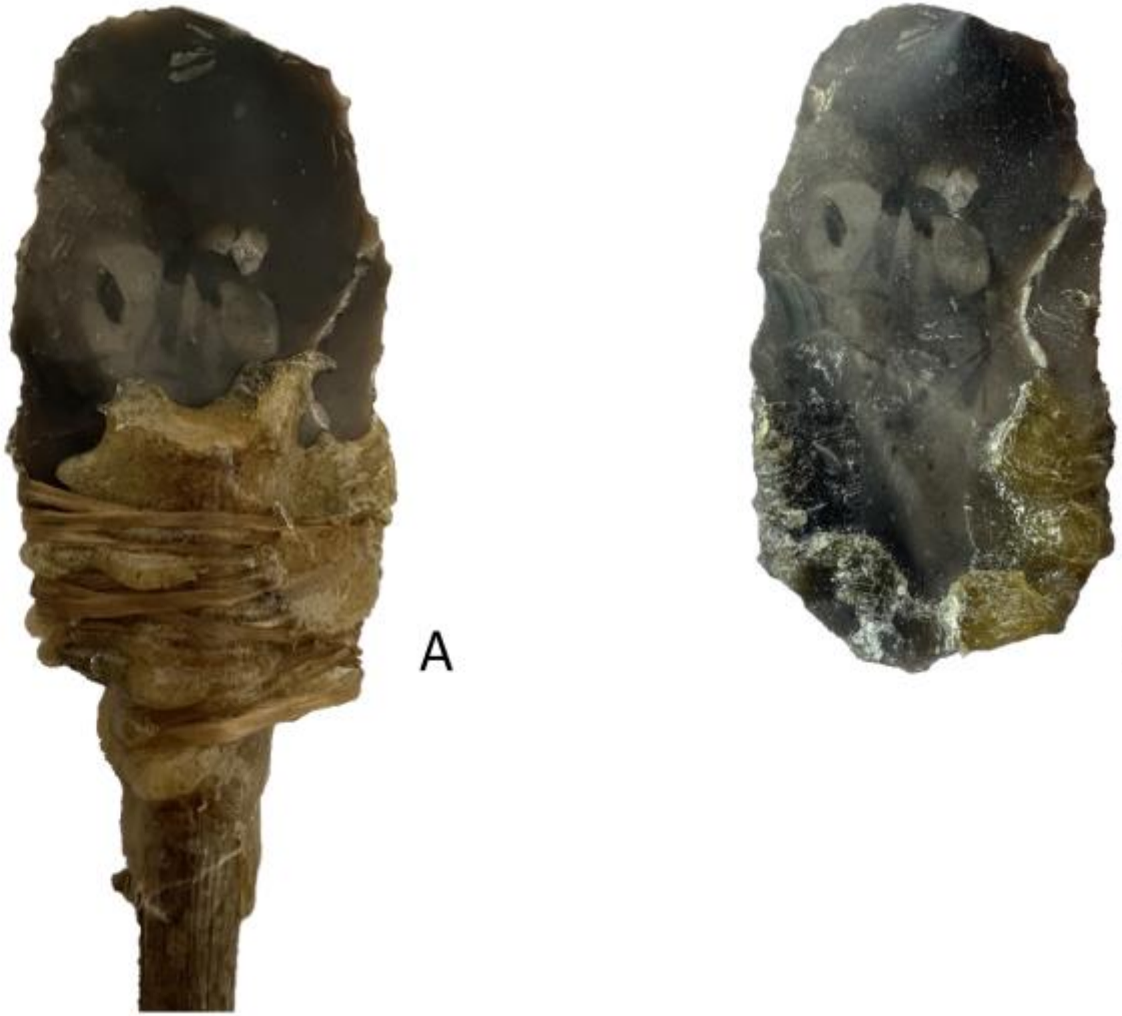


Figure 101. Plain Chios mastic (A) before and (B) after testing.

Figure 102. Compound Chios mastic (A) before and (B) after testing.

Figure 103. Plain cow blood glue (A) before and (B) after testing.

Figure 104. Compound cow blood glue (A) before and (B) after testing.

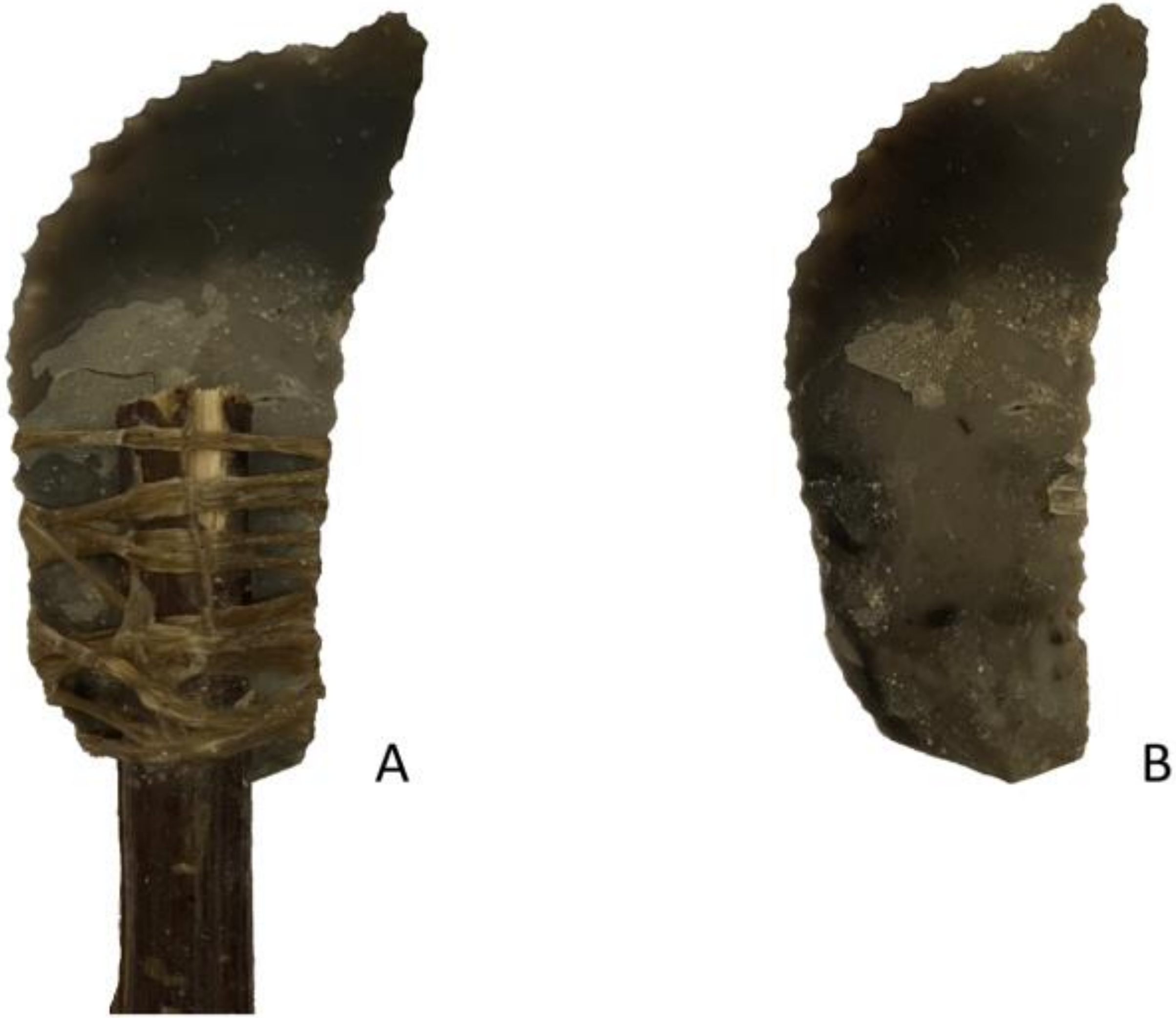


Figure 105. Plain deer bone glue (A) before and (B) after testing.

Figure 106. Compound deer bone glue (A) before and (B) after testing.

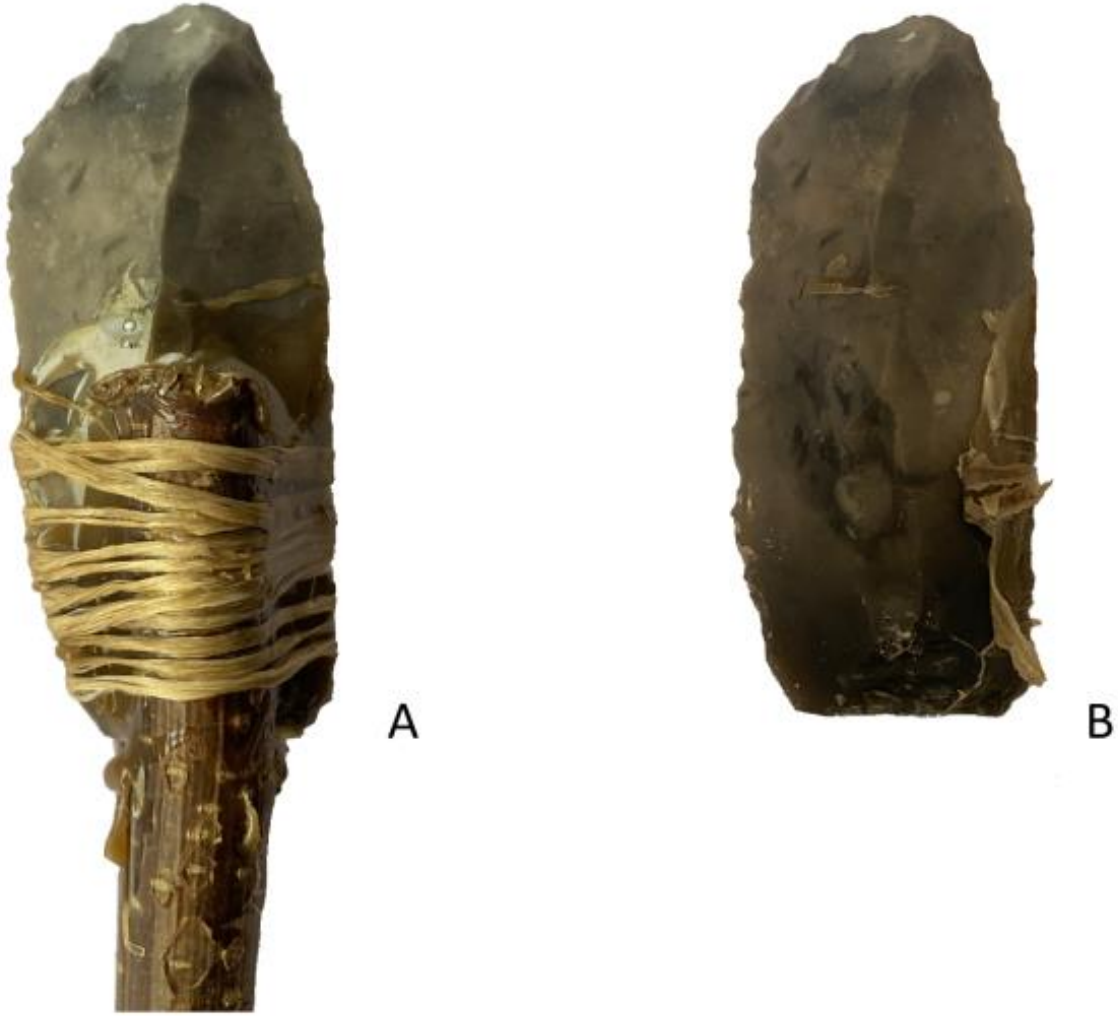


Figure 107. Plain deer hide glue (A) before and (B) after testing.

Figure 108. Compound deer hide glue (A) before and (B) after testing.

Figure 109. Plain egg white glue (A) before and (B) after testing.

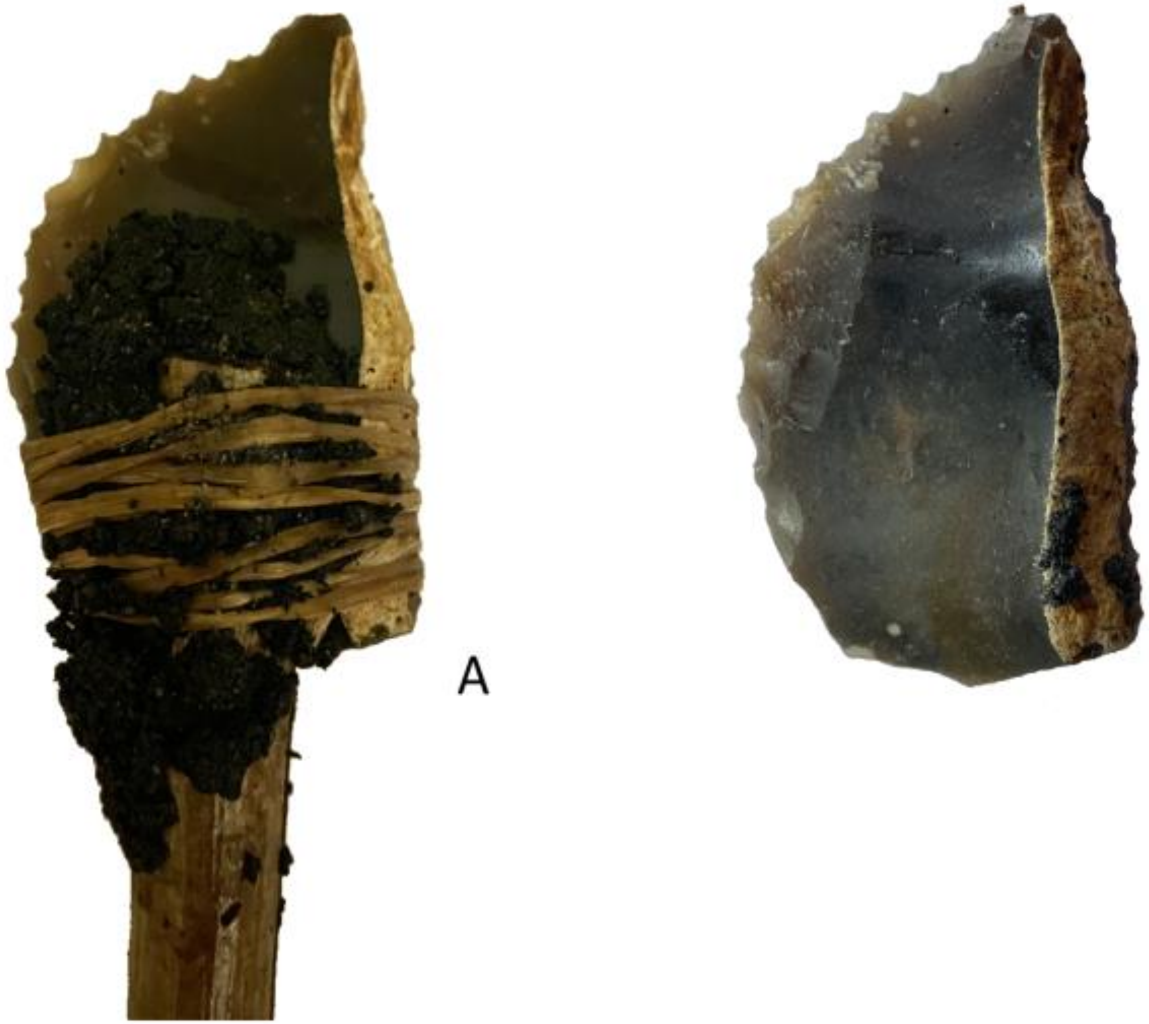


Figure 110. Compound egg white glue (A) before and (B) after testing.

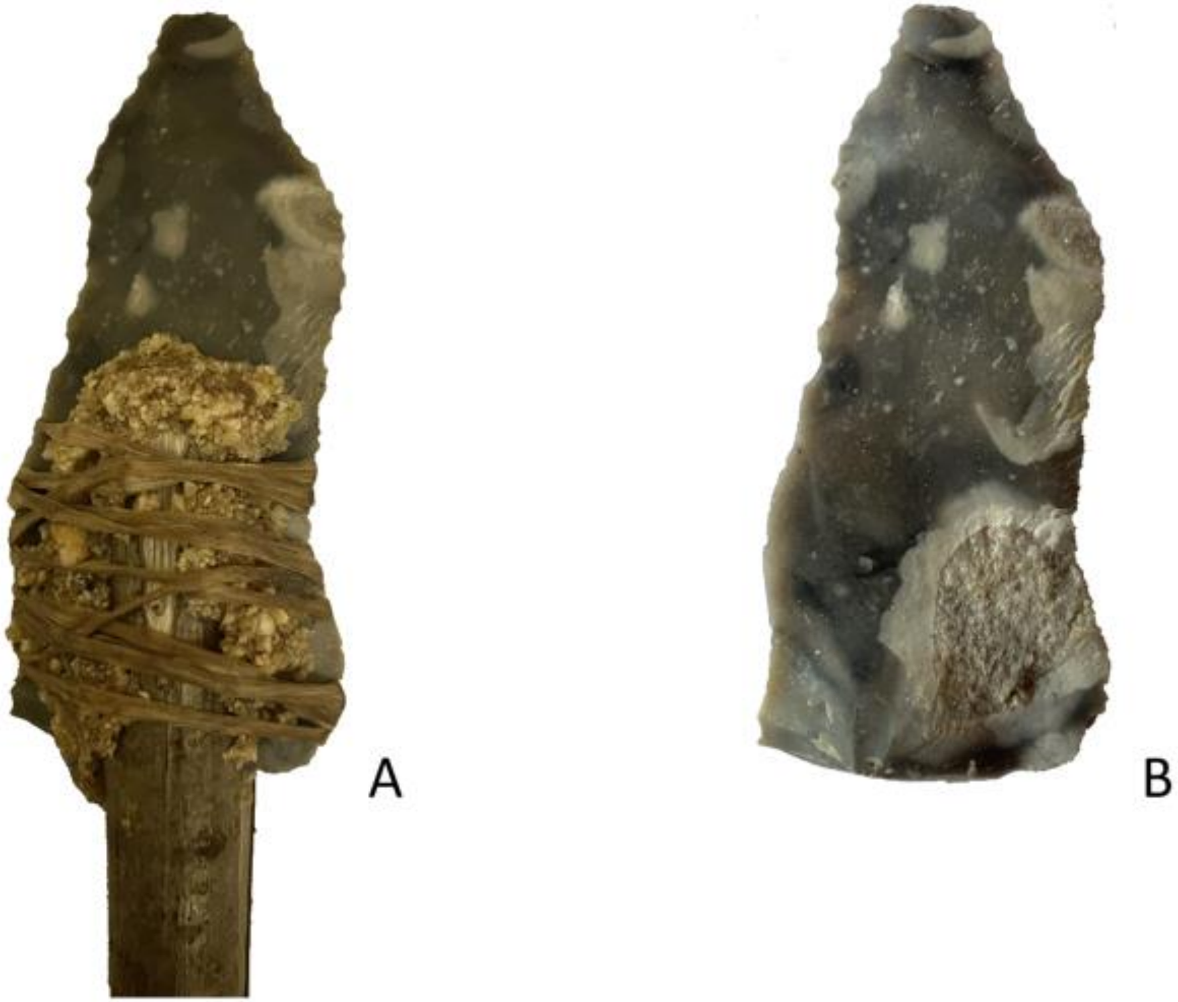


Figure 111. Plain frankincense (A) before and (B) after testing.

Figure 112. Compound frankincense (A) before and (B) after testing.

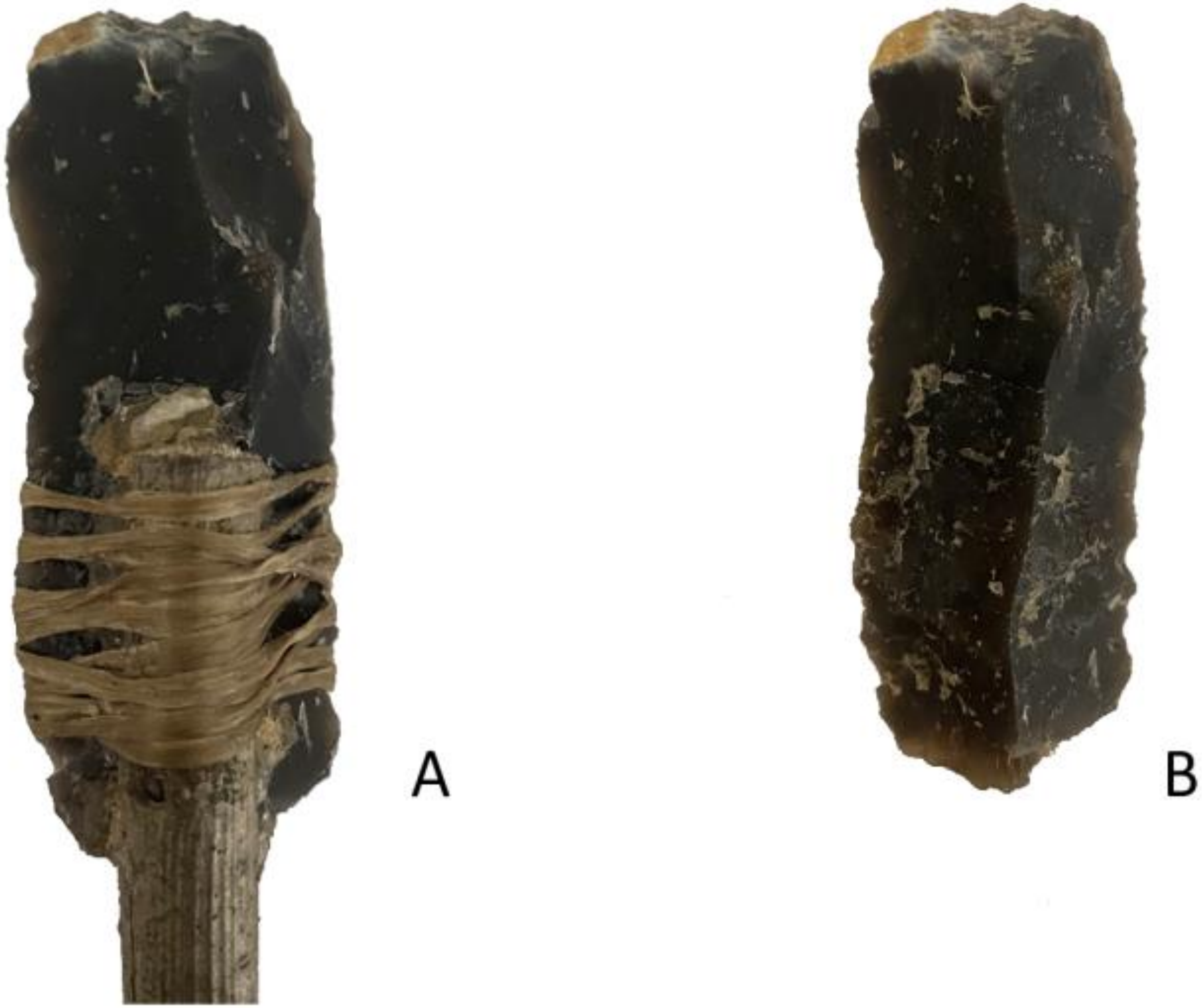


Figure 113. Plain gum tragacanth (A) before and (B) after testing.

Figure 114. Compound gum tragacanth (A) before and (B) after testing.

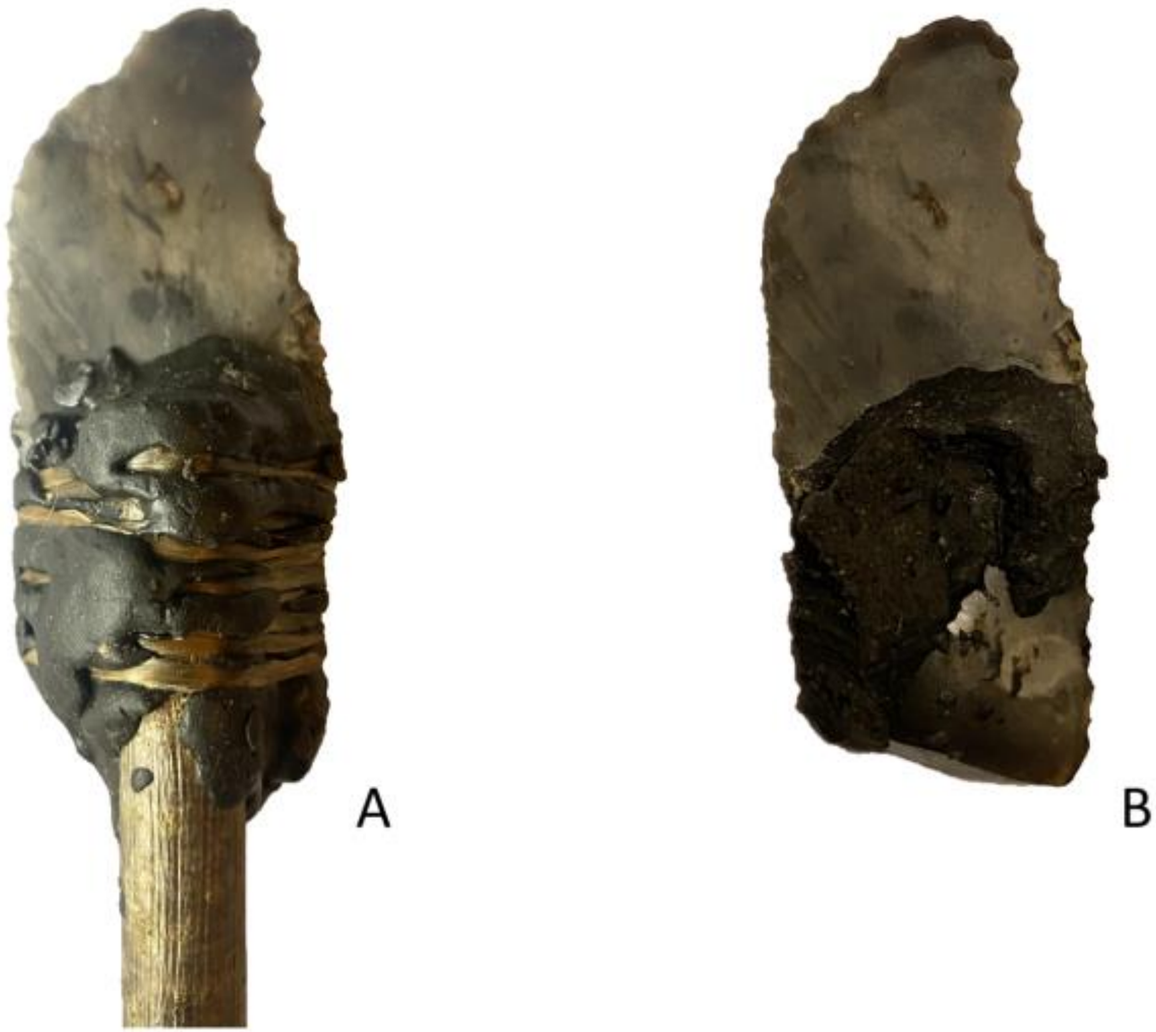


Figure 115. Plain labdanum (A) before and (B) after testing.

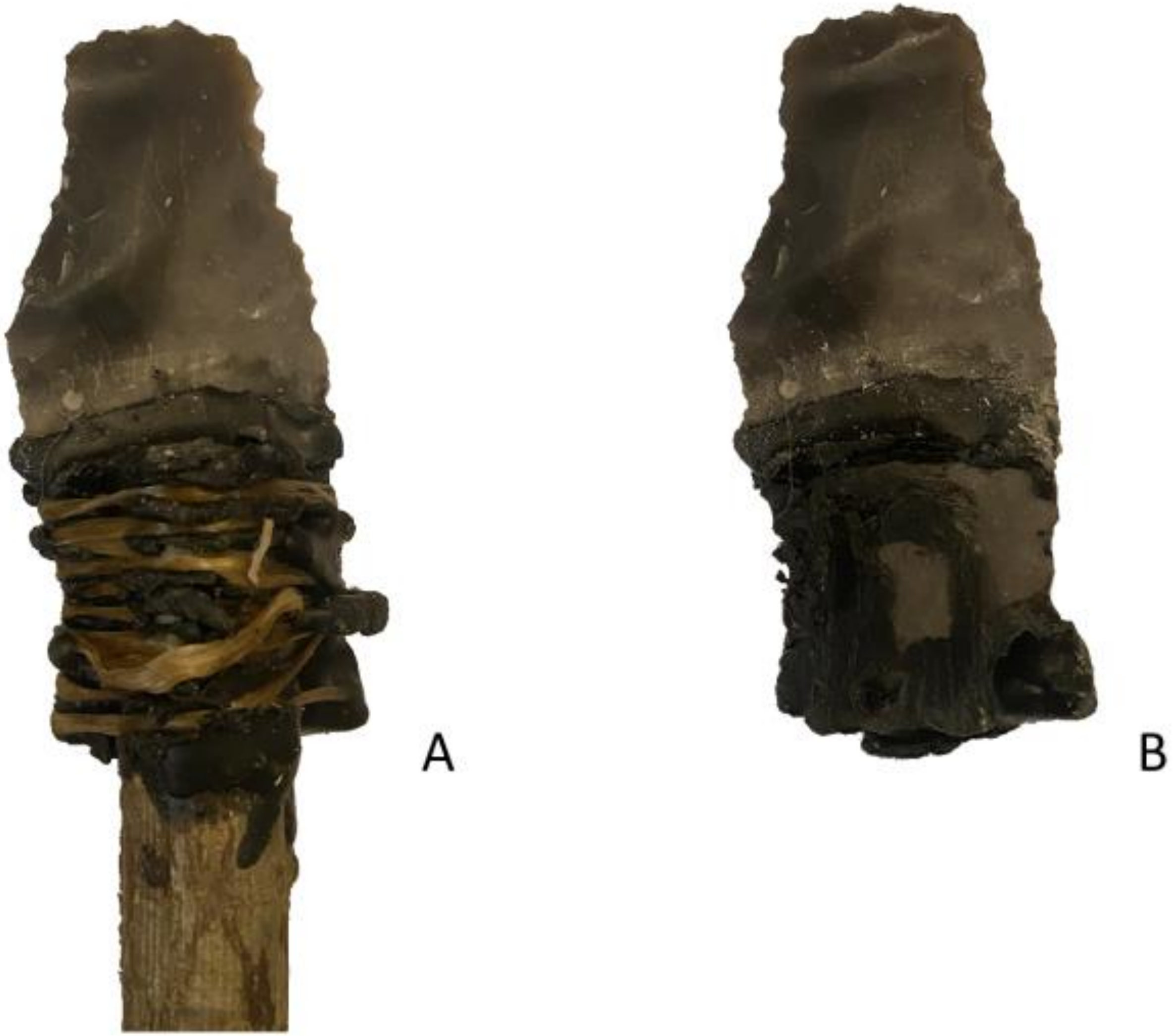


Figure 116. Compound labdanum (A) before and (B) after testing.

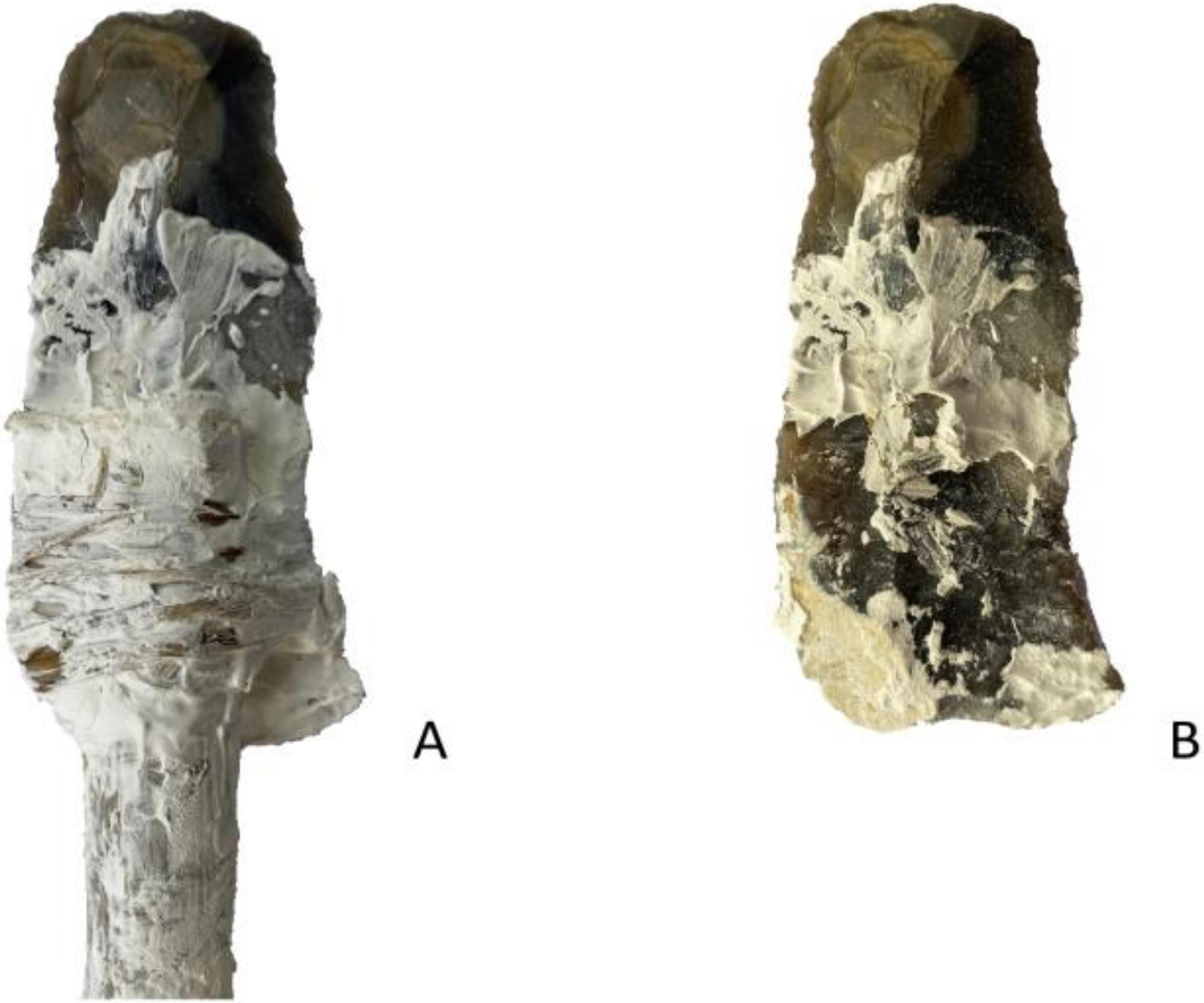


Figure 117. Plain lime plaster (A) before and (B) after testing.

Figure 118. Compound lime plaster (A) before and (B) after testing.

Figure 119. Plain milk casein (A) before and (B) after testing.

Figure 120. Compound milk casein (A) before and (B) after testing.

Figure 121. Plain myrrh (A) before and (B) after testing.

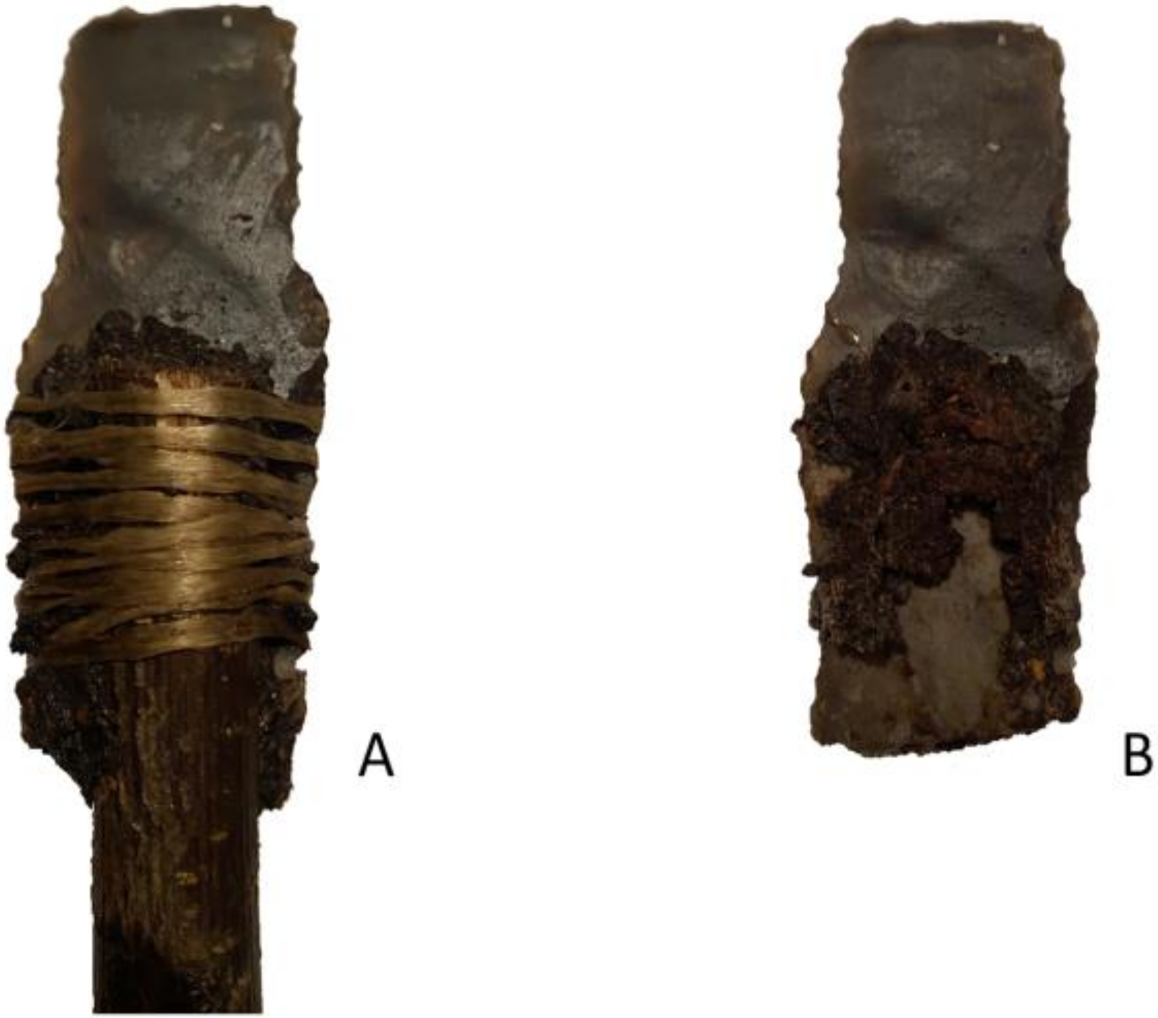


Figure 122. Compound myrrh (A) before and (B) after testing.

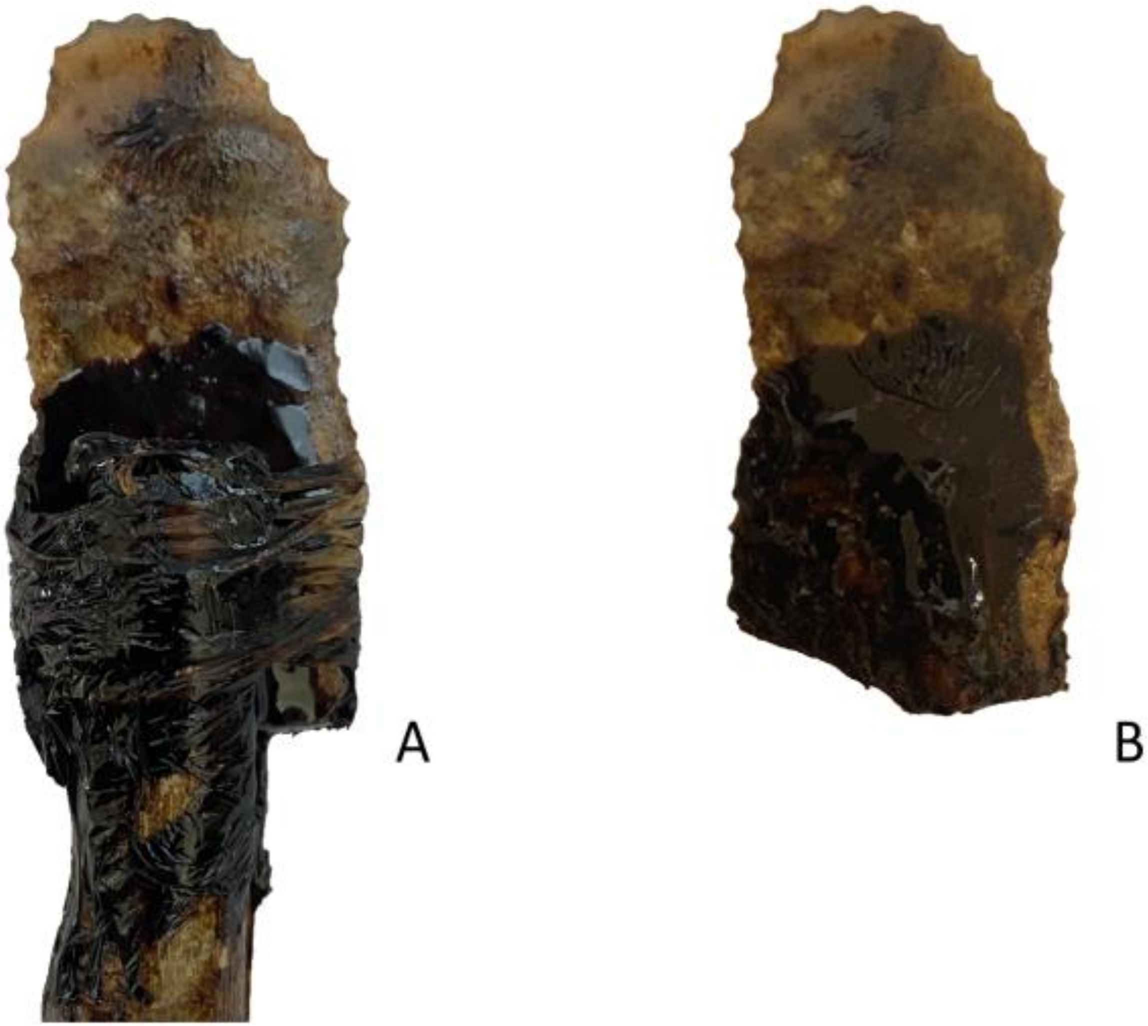


Figure 123. Plain nettle latex (A) before and (B) after testing.

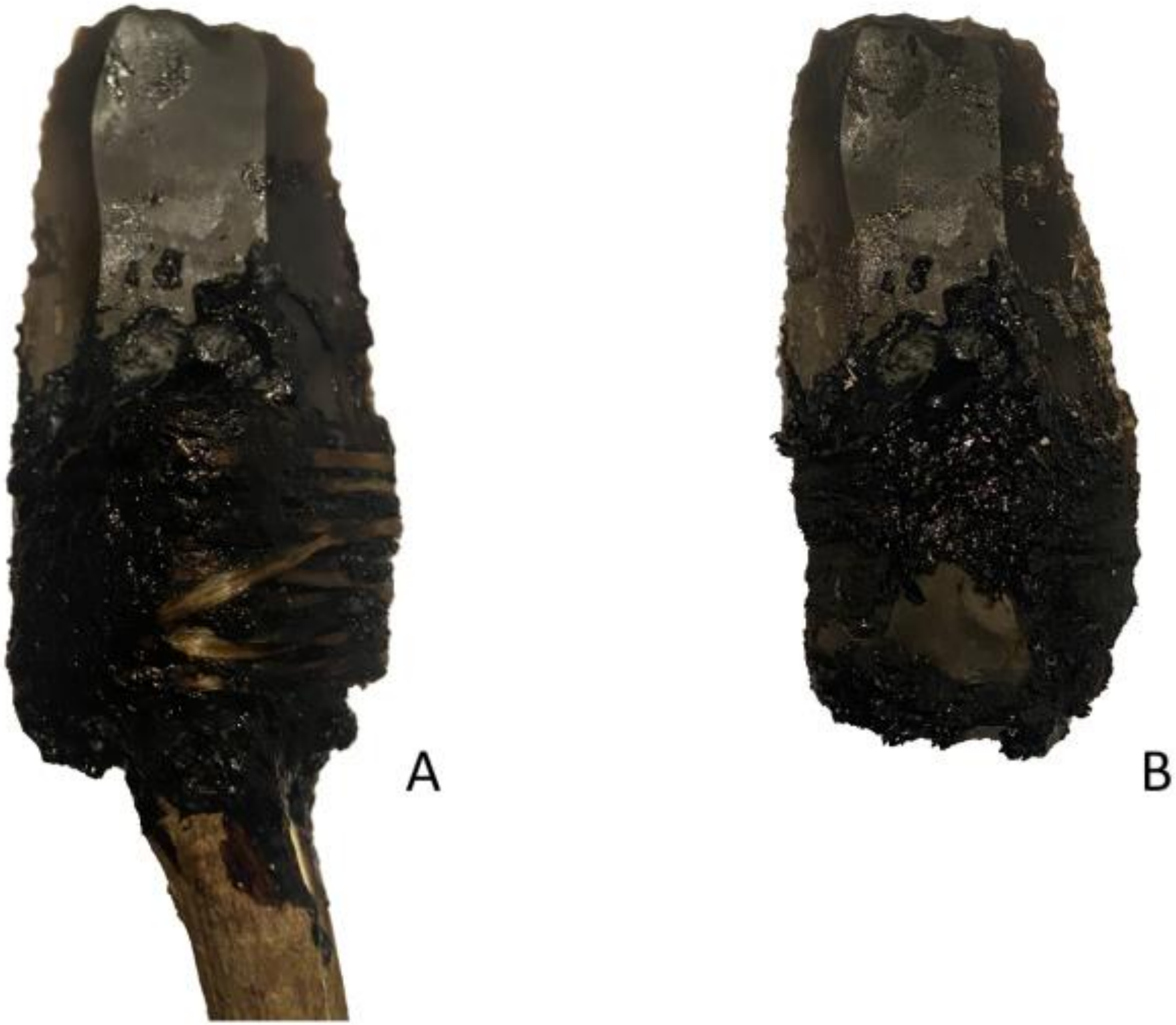


Figure 124. Compound nettle latex (A) before and (B) after testing.

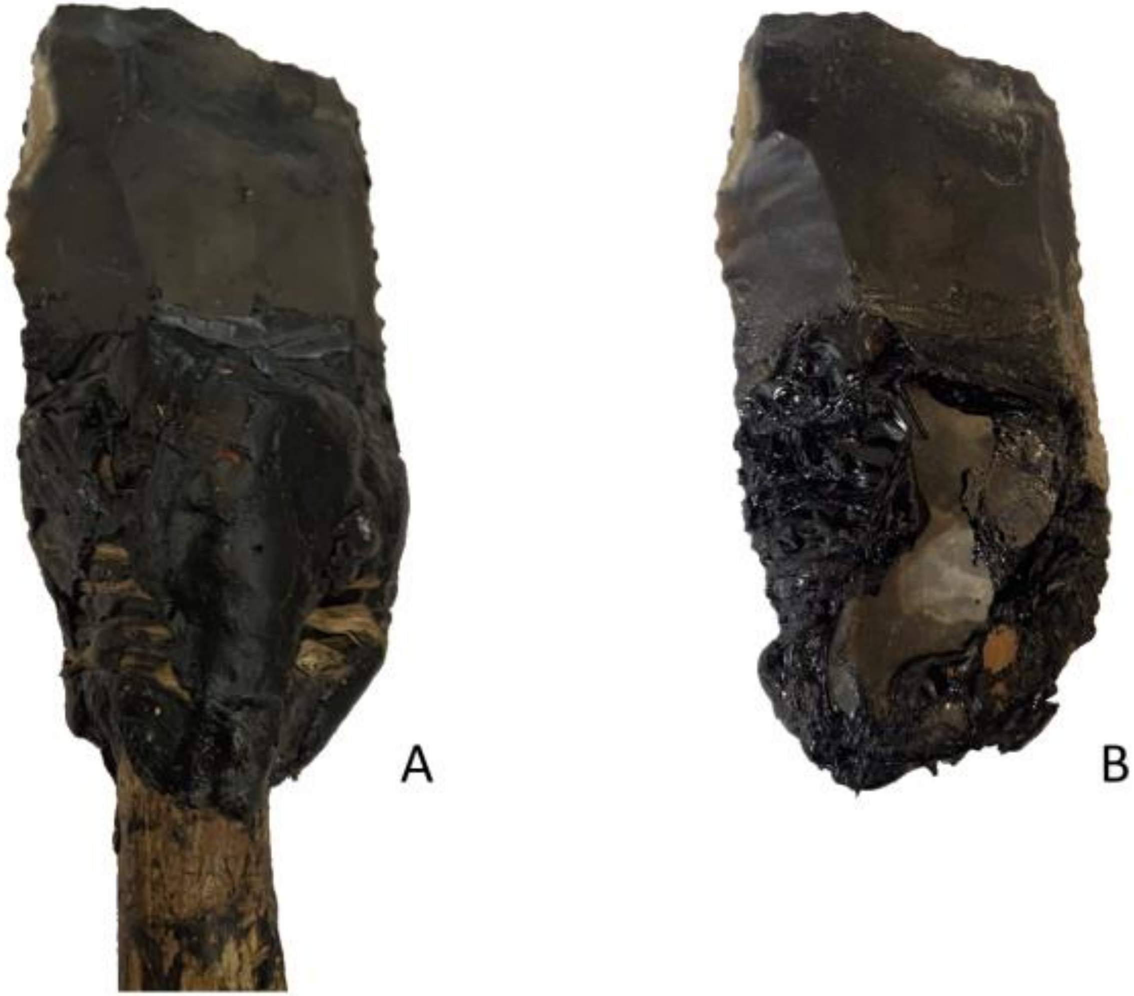


Figure 125. Plain pine bark tar (A) before and (B) after testing.

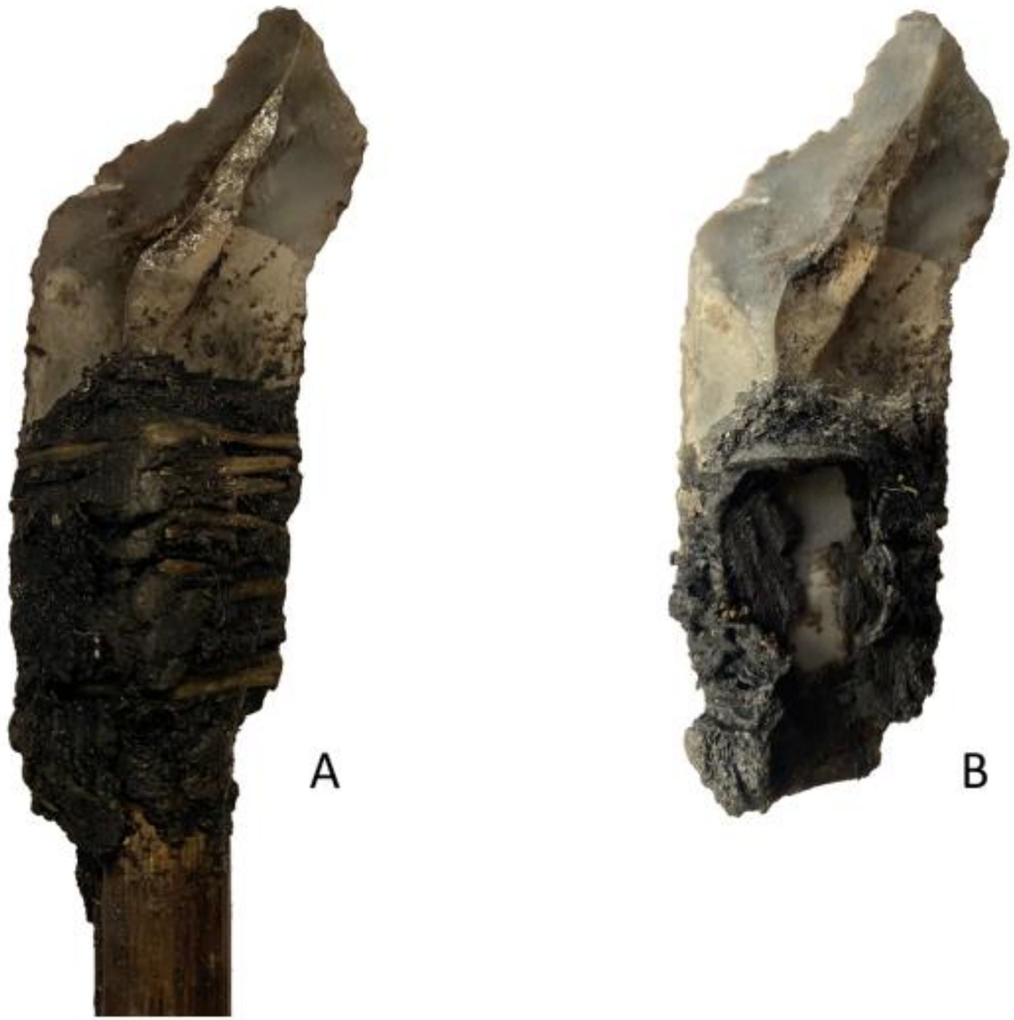


Figure 126. Compound pine bark tar (A) before and (B) after testing.

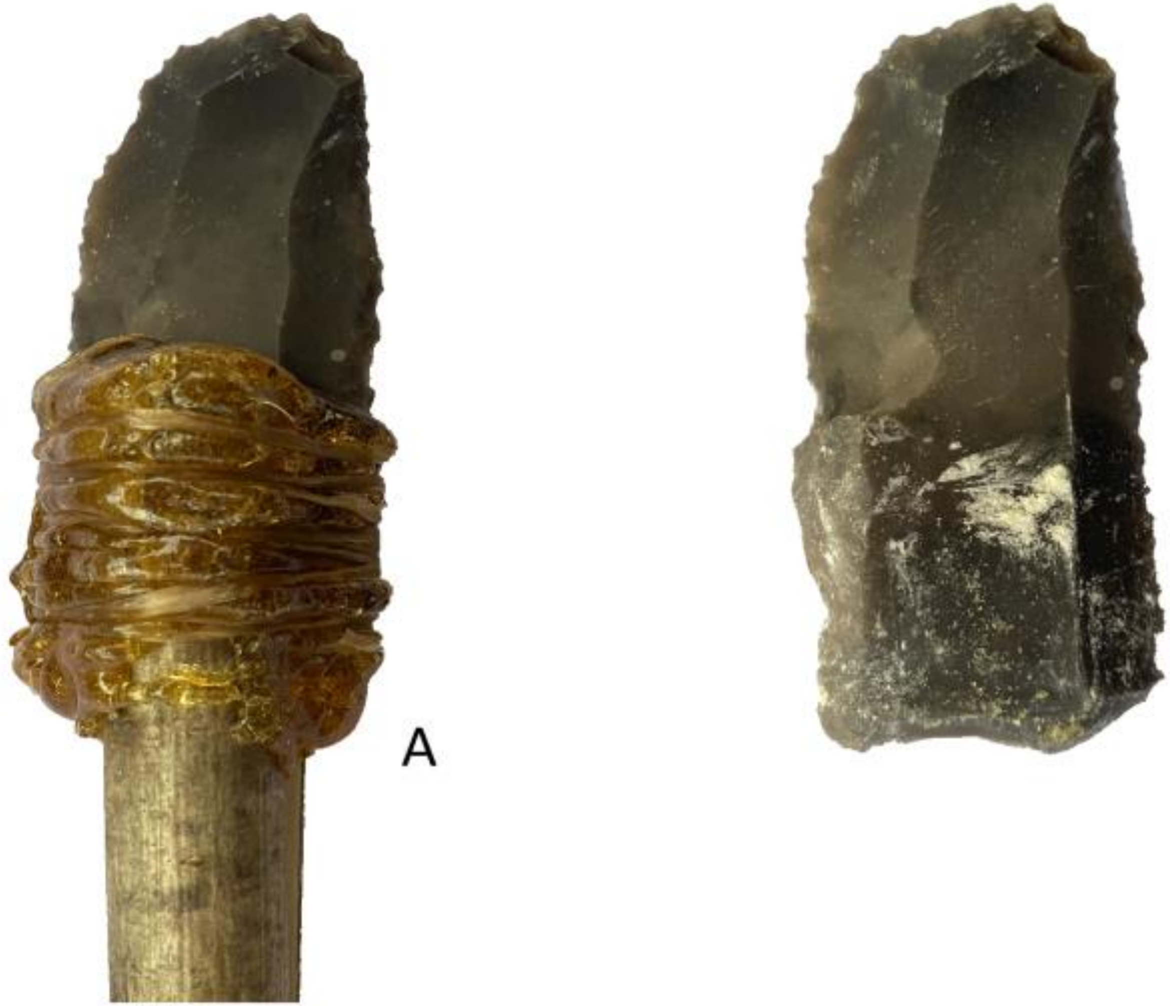


Figure 127. Plain pine resin (A) before and (B) after testing.

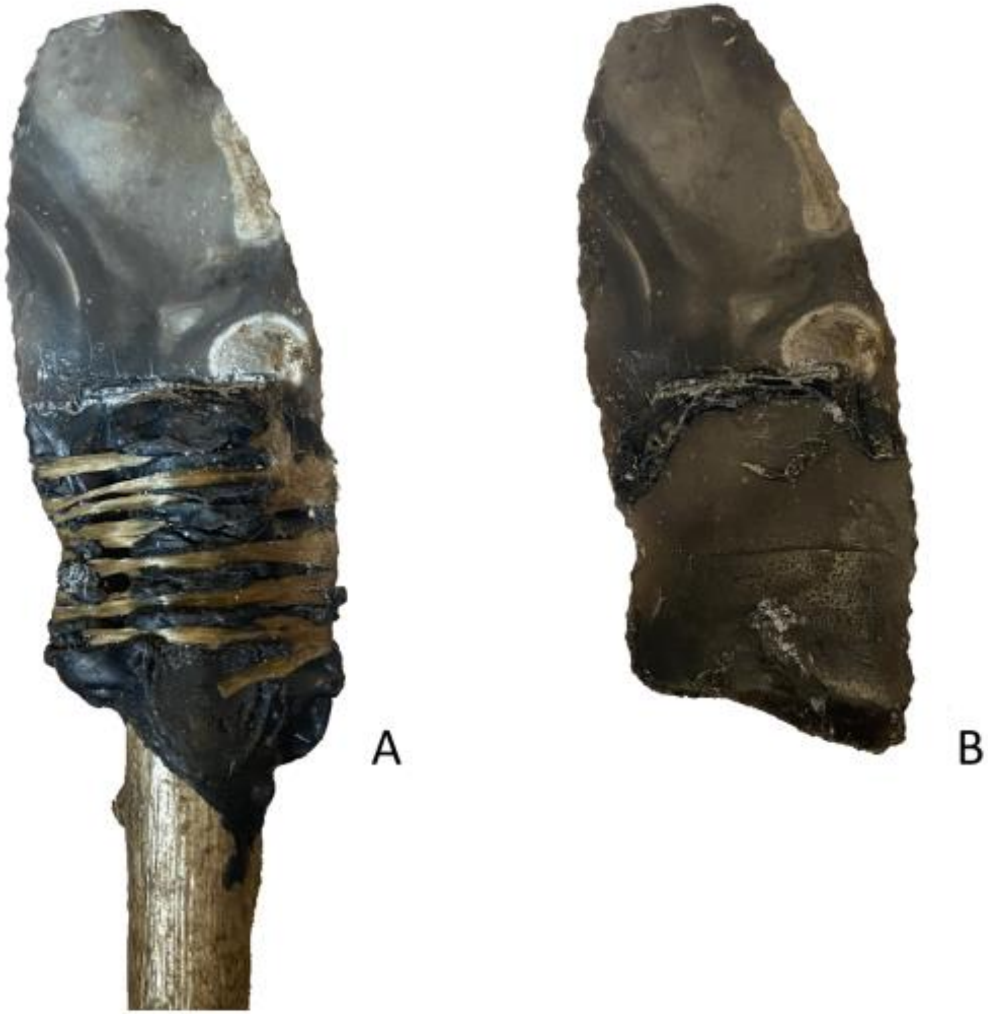


Figure 128. Composite pine resin (A) before and (B) after testing.

Figure 129. Plain sandarac (A) before and (B) after testing.

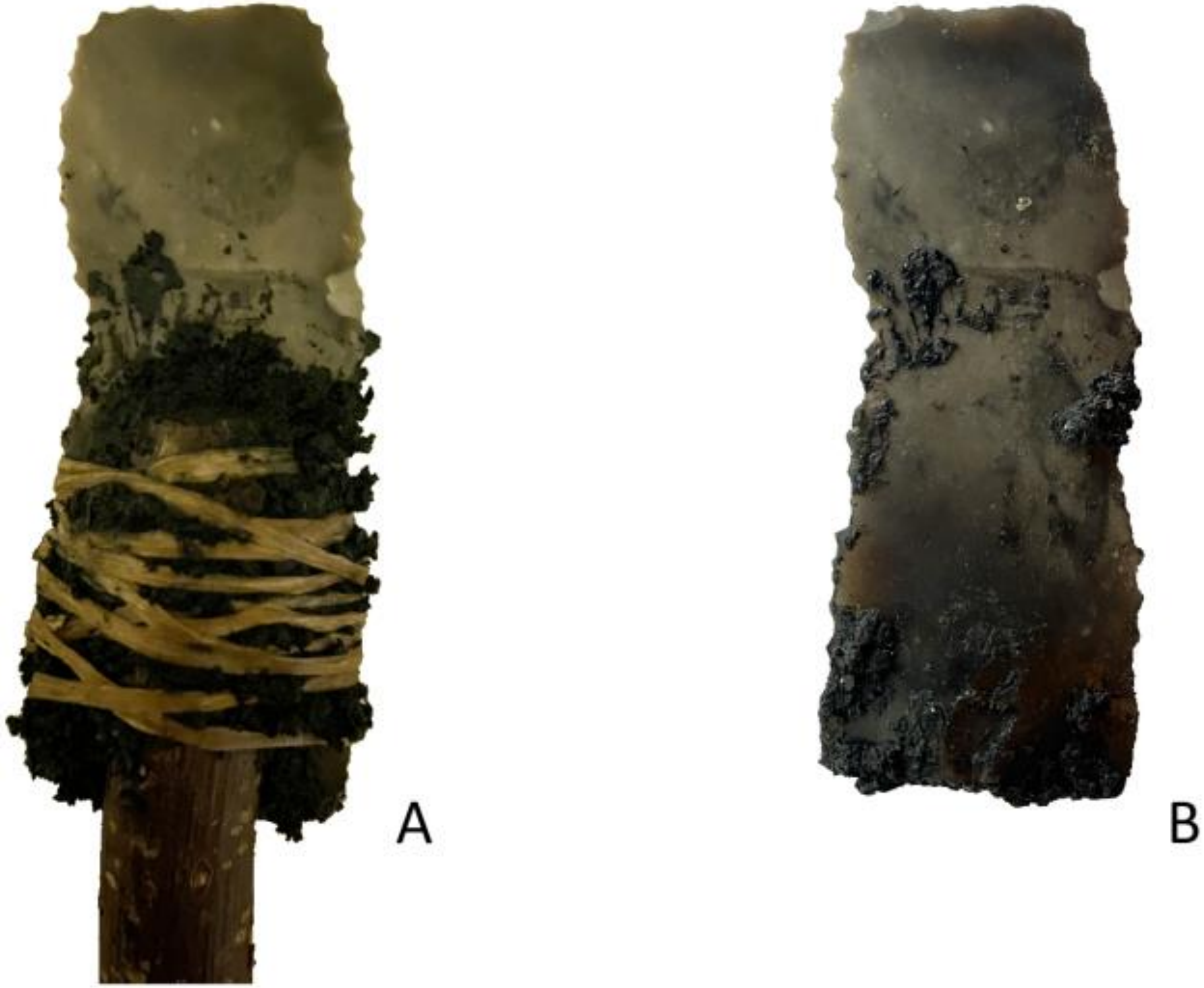


Figure 130. Compound sandarac (A) before and (B) after testing.

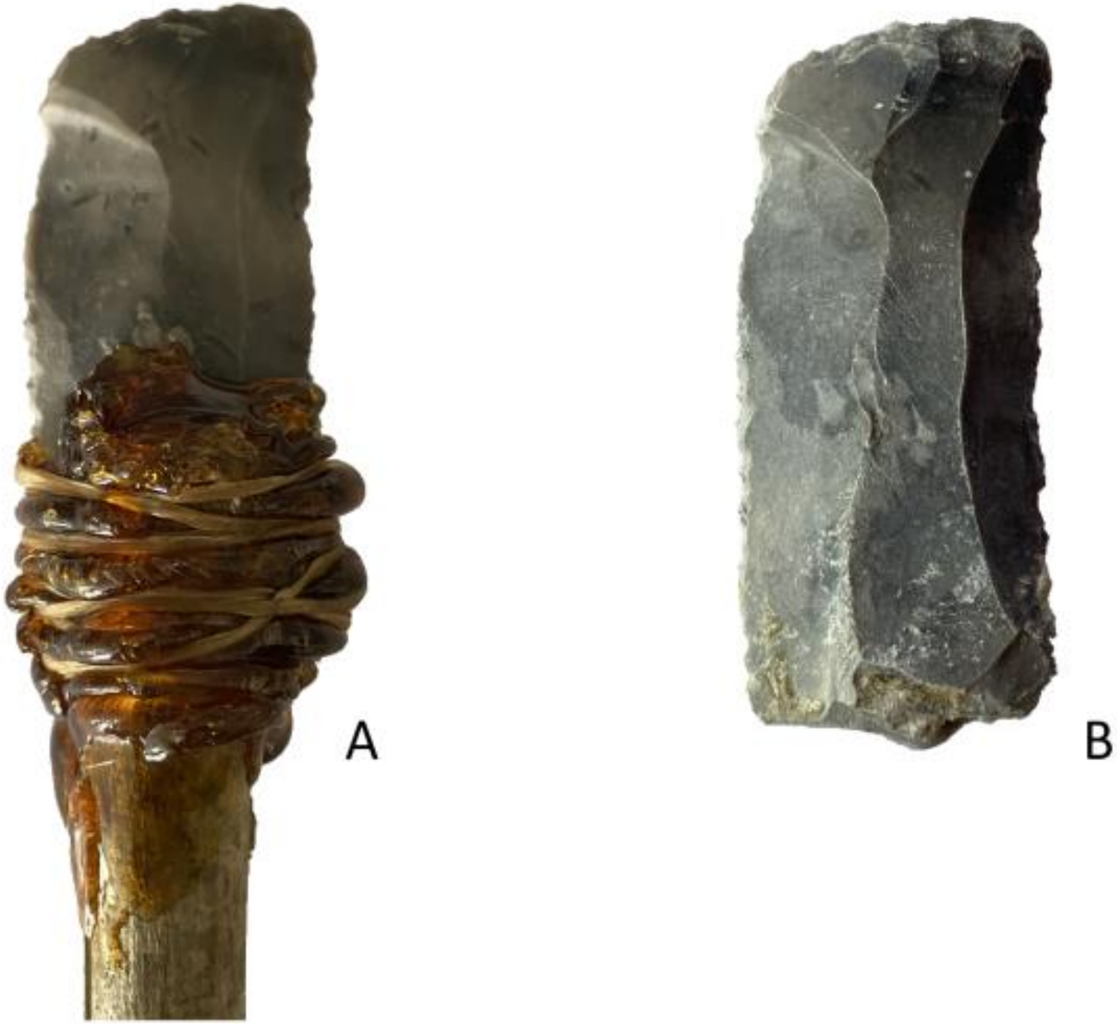


Figure 131. Plain spruce resin (A) before and (B) after testing.

Figure 132. Compound spruce resin (A) before and (B) after testing.

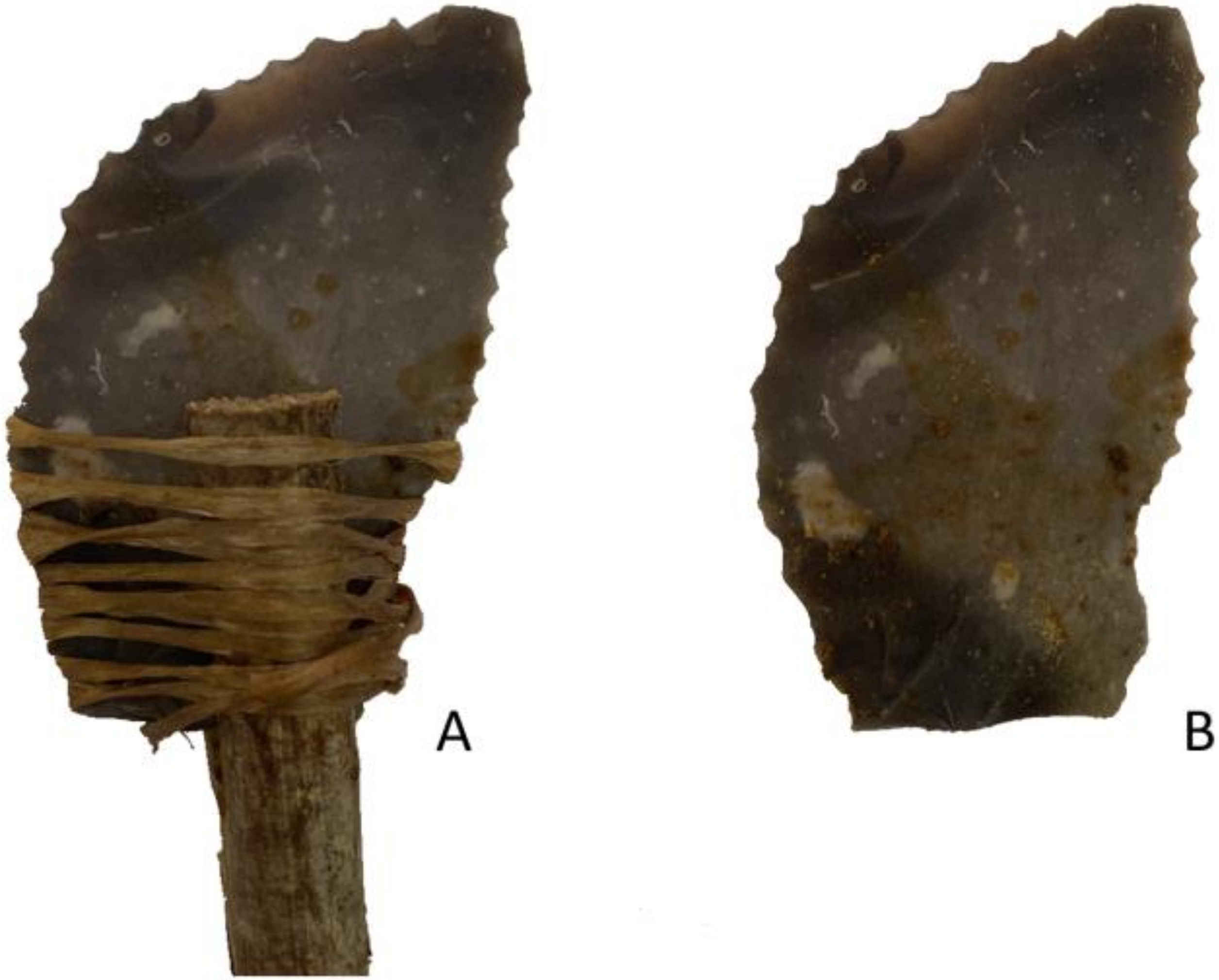


Figure 133. Plain trout bone glue (A) before and (B) after testing.

Figure 134. Compound trout bone glue (A) before and (B) after testing.

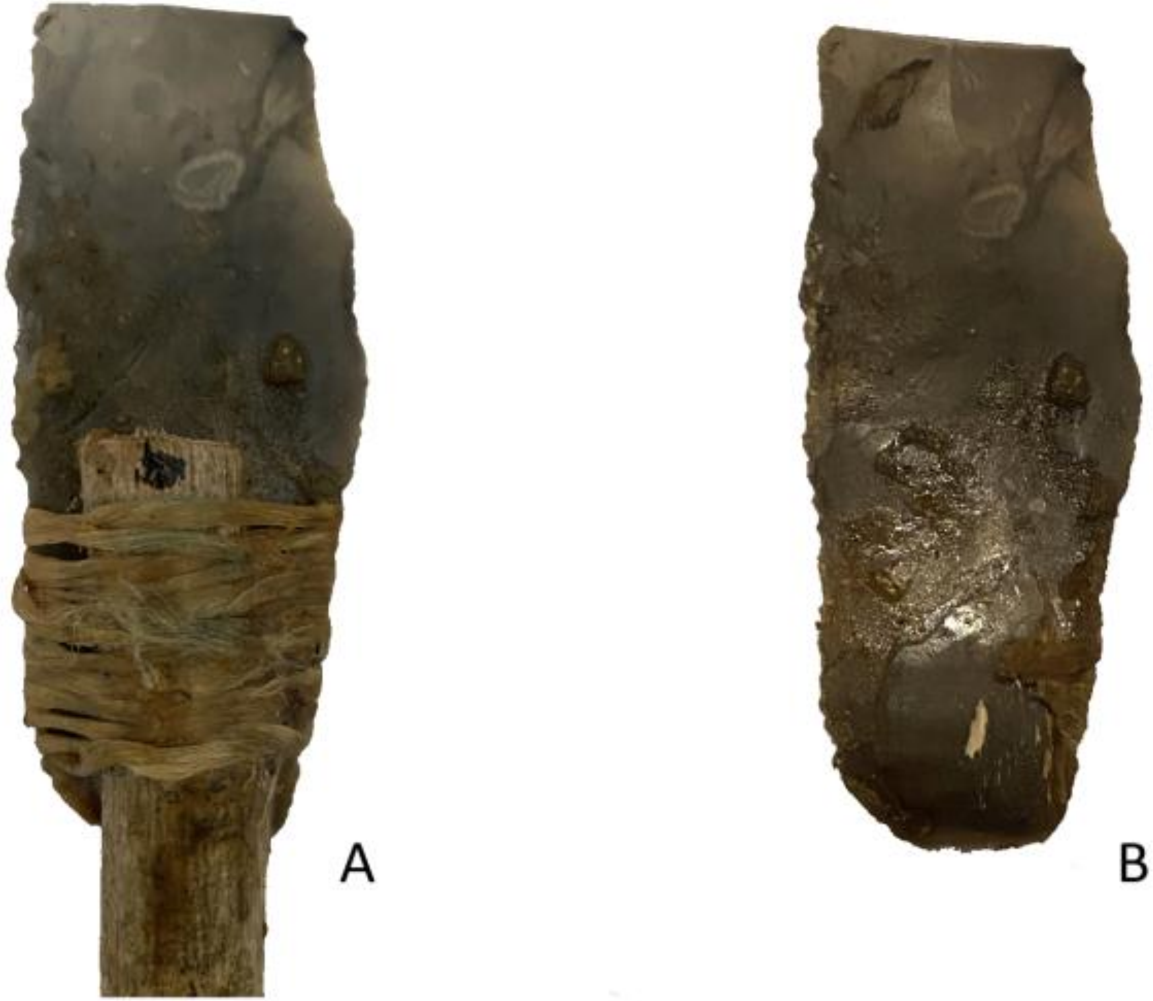


Figure 135. Plain trout skin glue (A) before and (B) after testing.

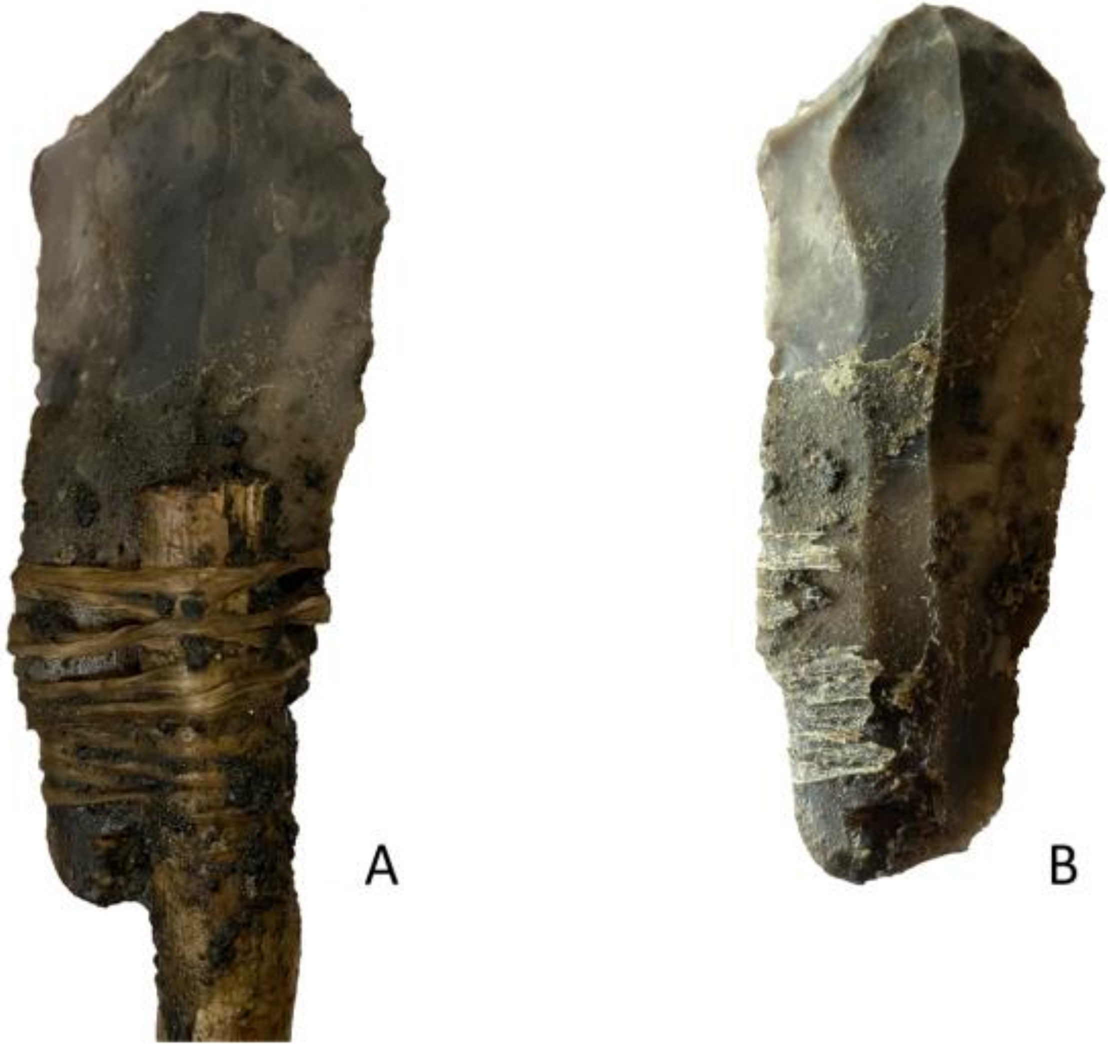


Figure 136. Compound trout skin glue (A) before and (B) after testing.

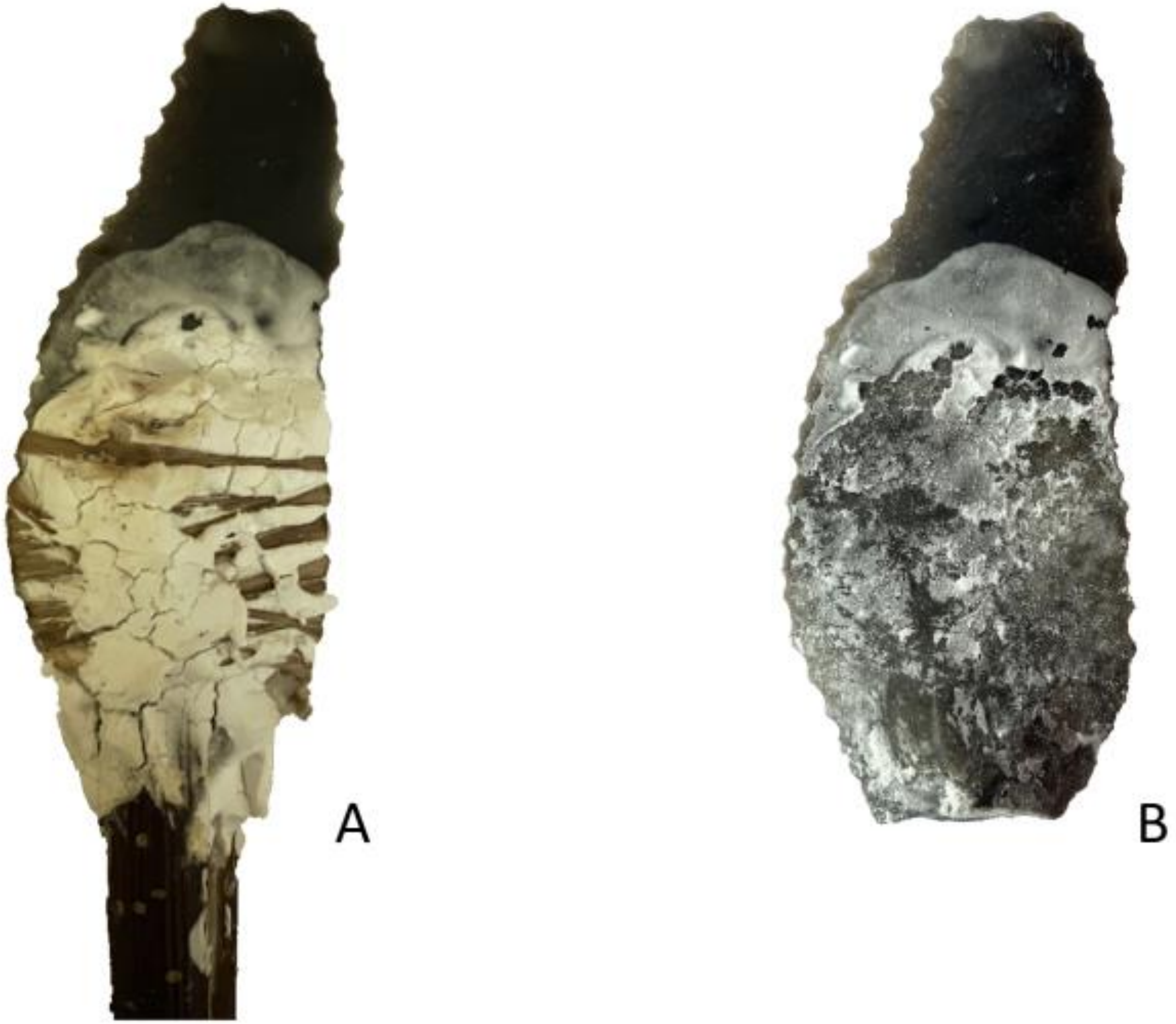


Figure 137. Plain wheat starch glue (A) before and (B) after testing.

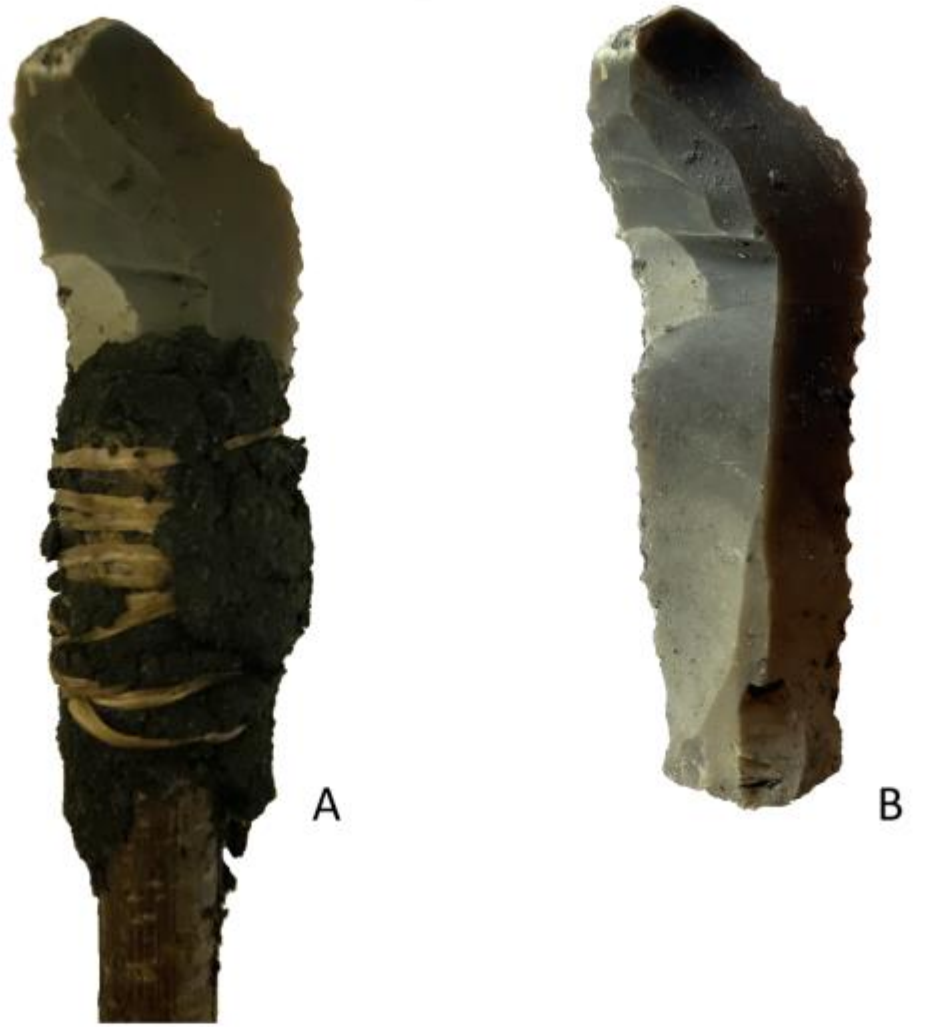


Figure 138. Compound wheat starch glue (A) before and (B) after testing.

A9: Photographs of Glued Cubes

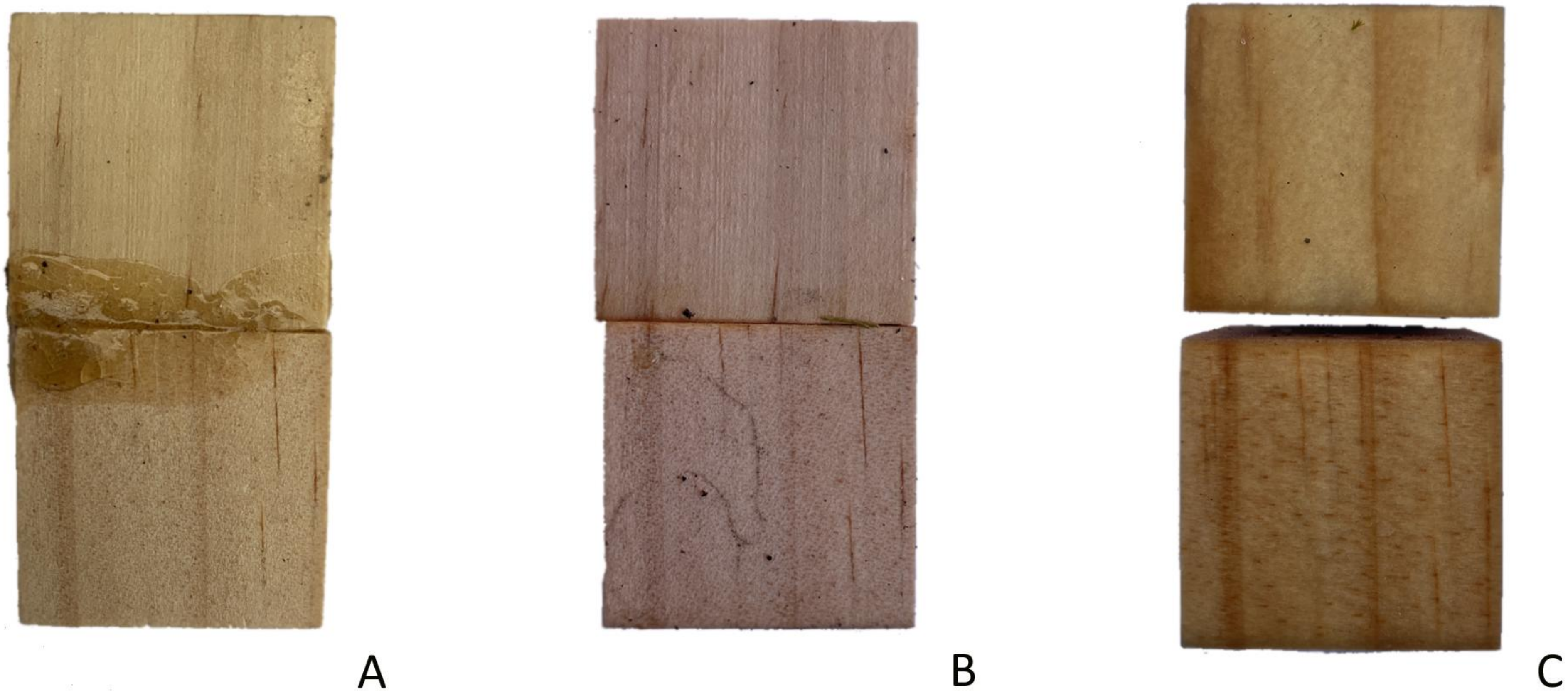


Figure 139. Plain acacia gum (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

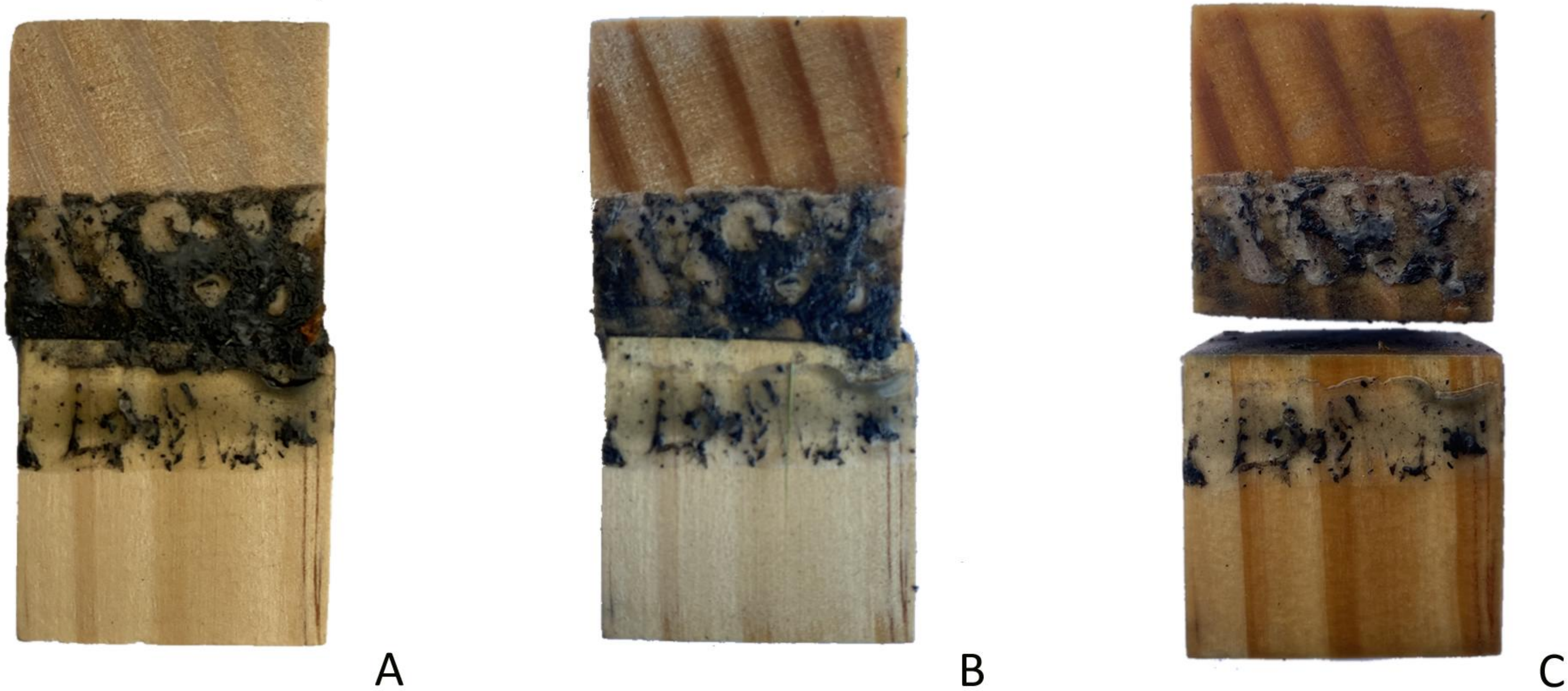


Figure 140. Compound acacia gum (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

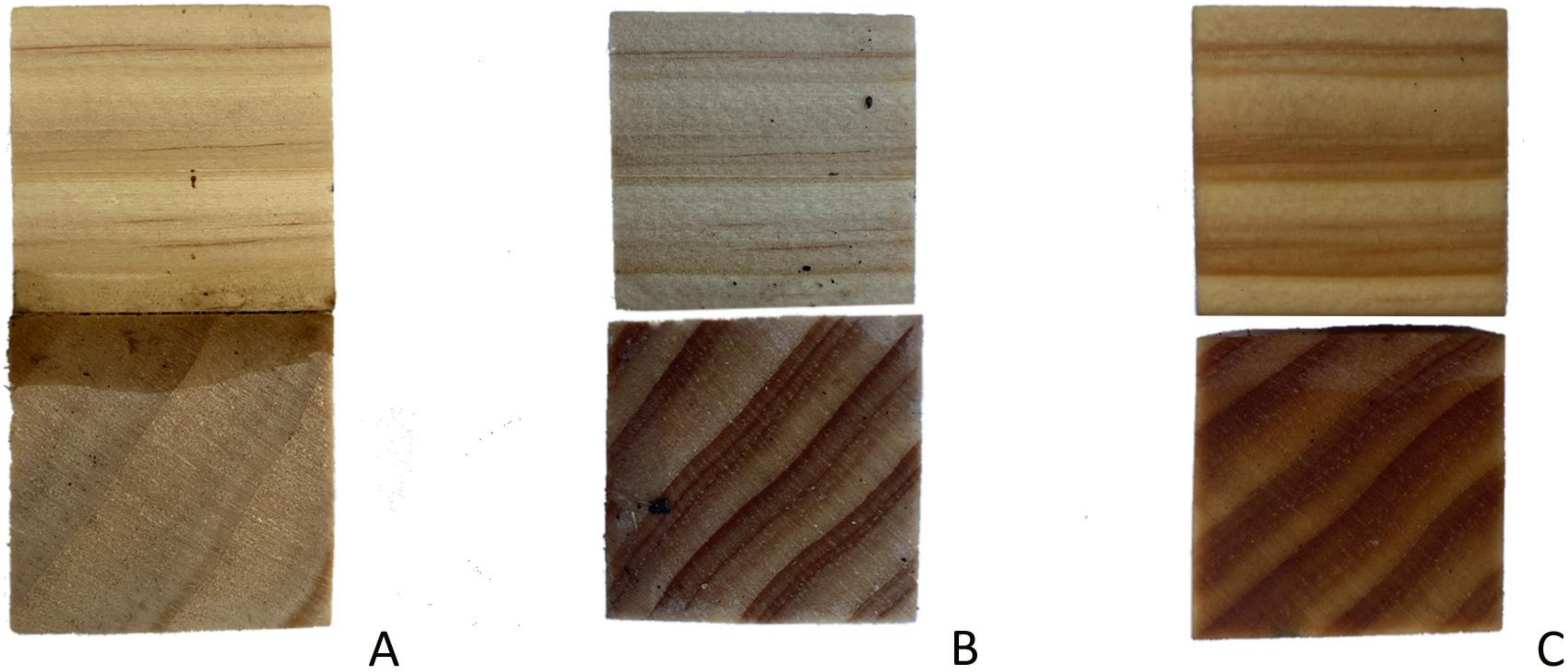


Figure 141. Plain asafoetida (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

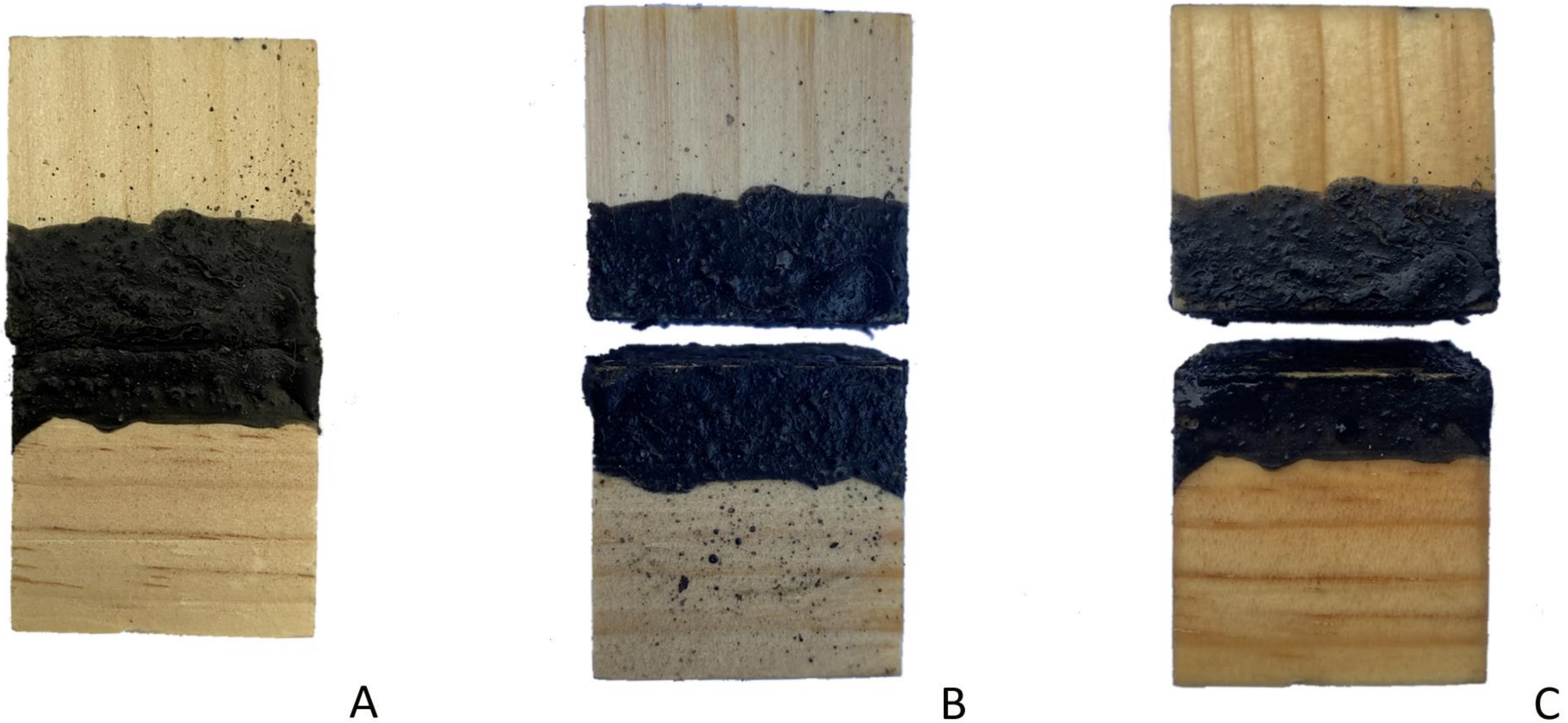


Figure 142. Compound asafoetida (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

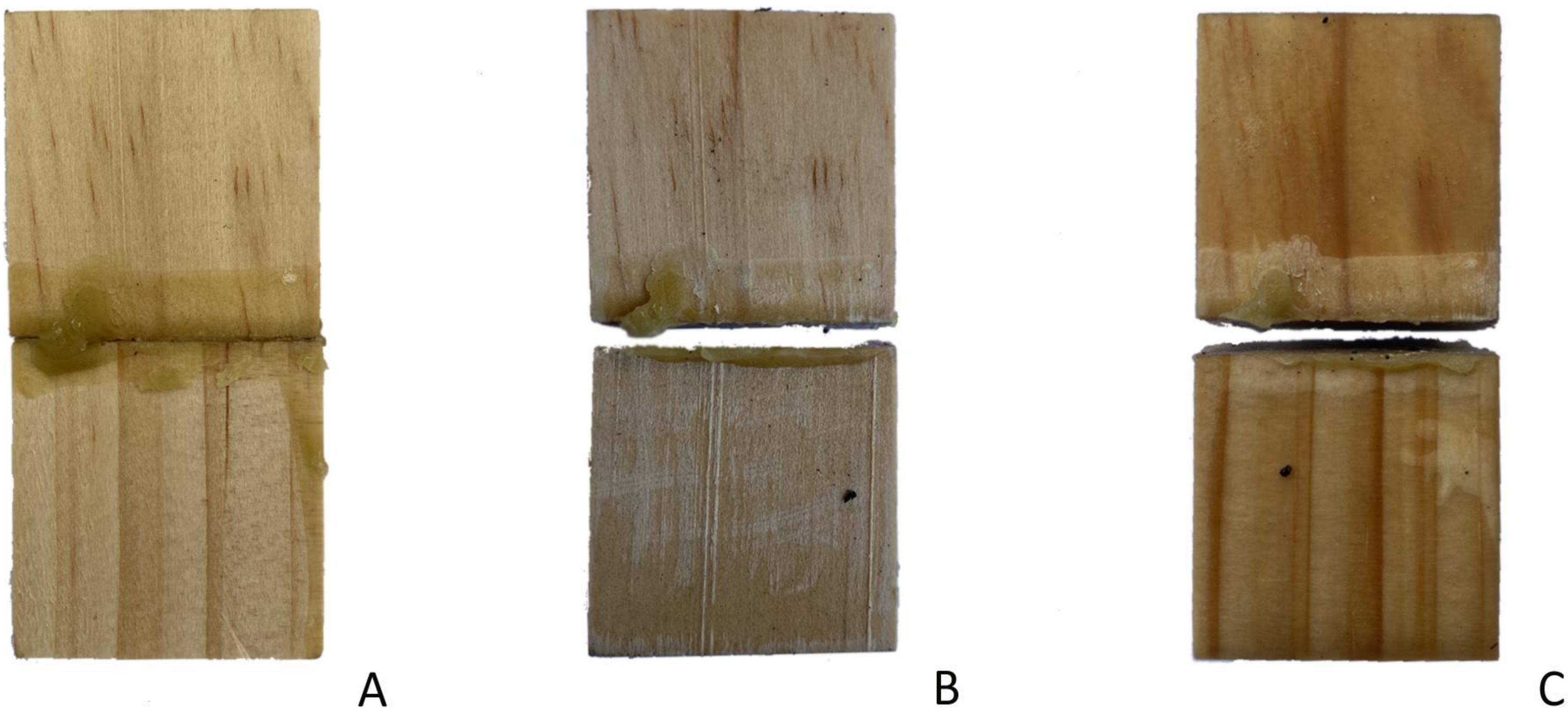


Figure 143. Plain beeswax (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

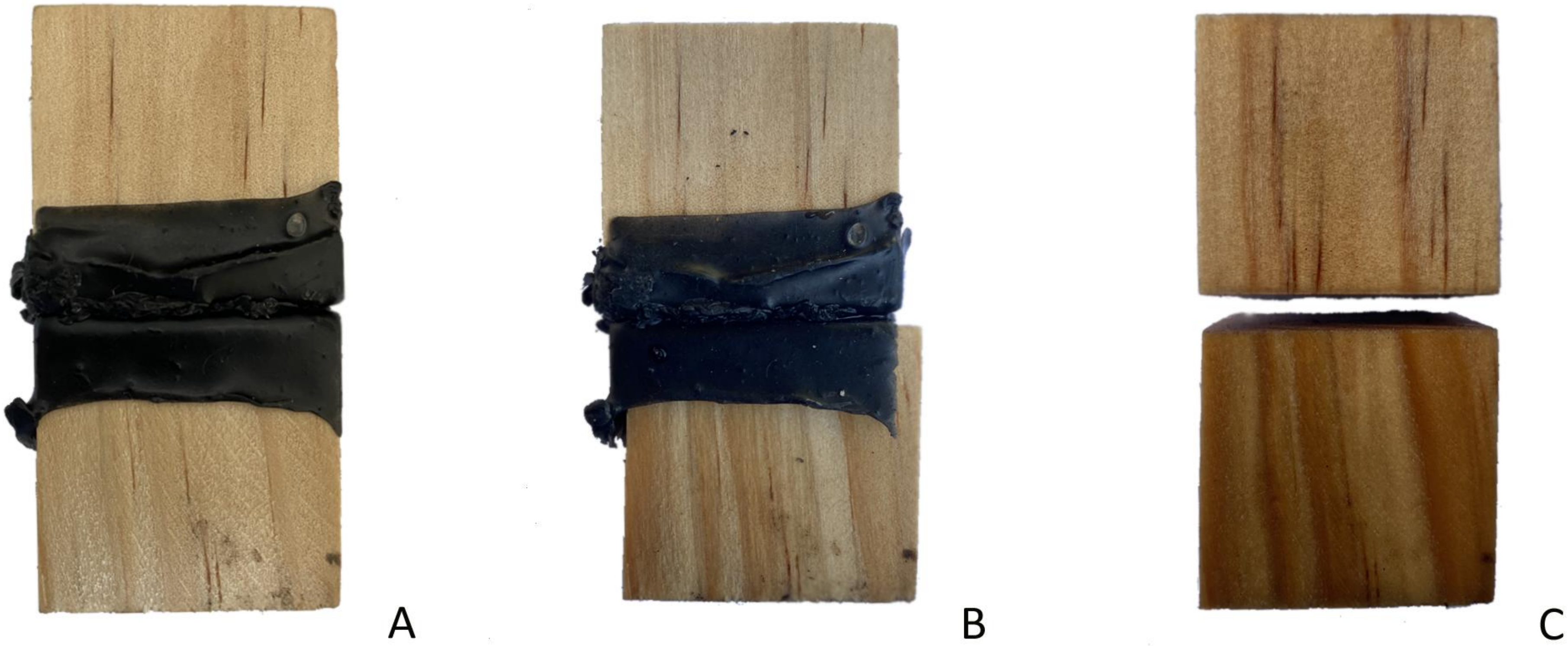


Figure 144. Compound beeswax (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

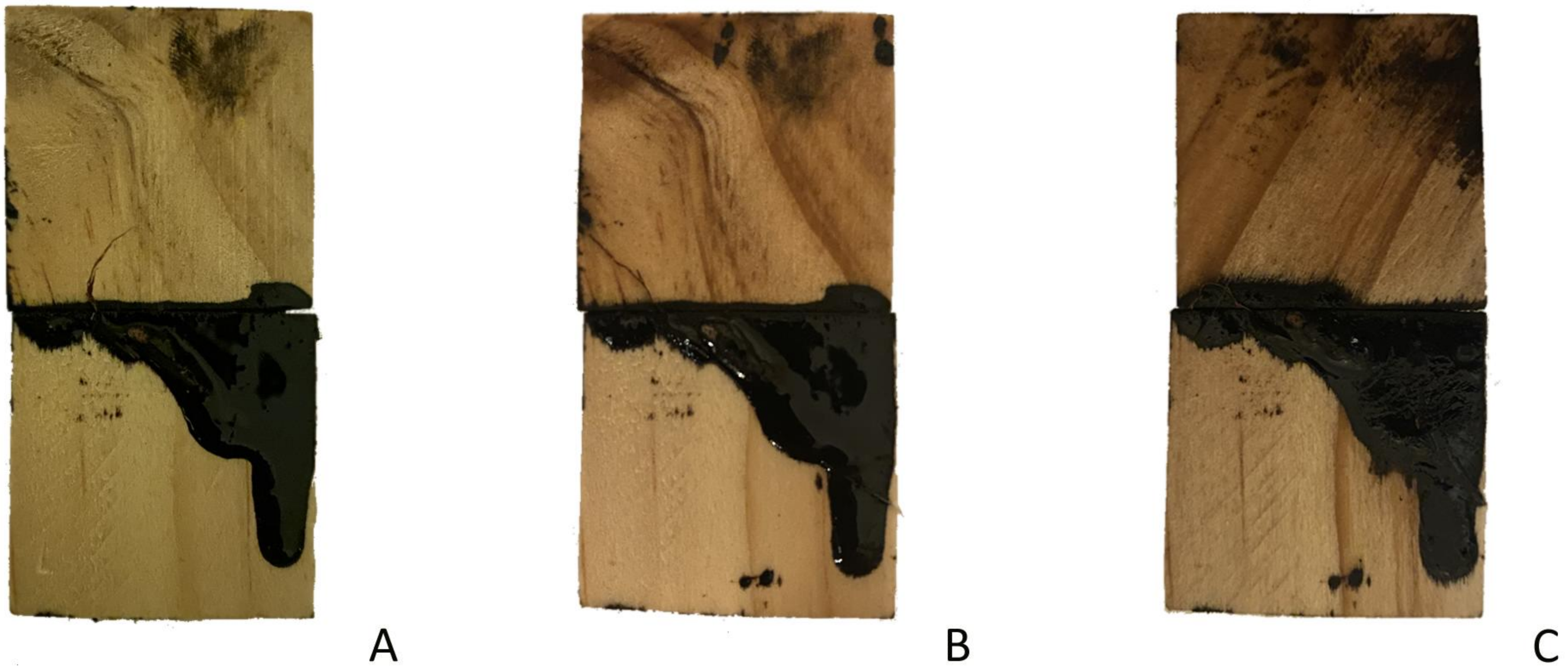


Figure 145. Plain birch bark tar (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

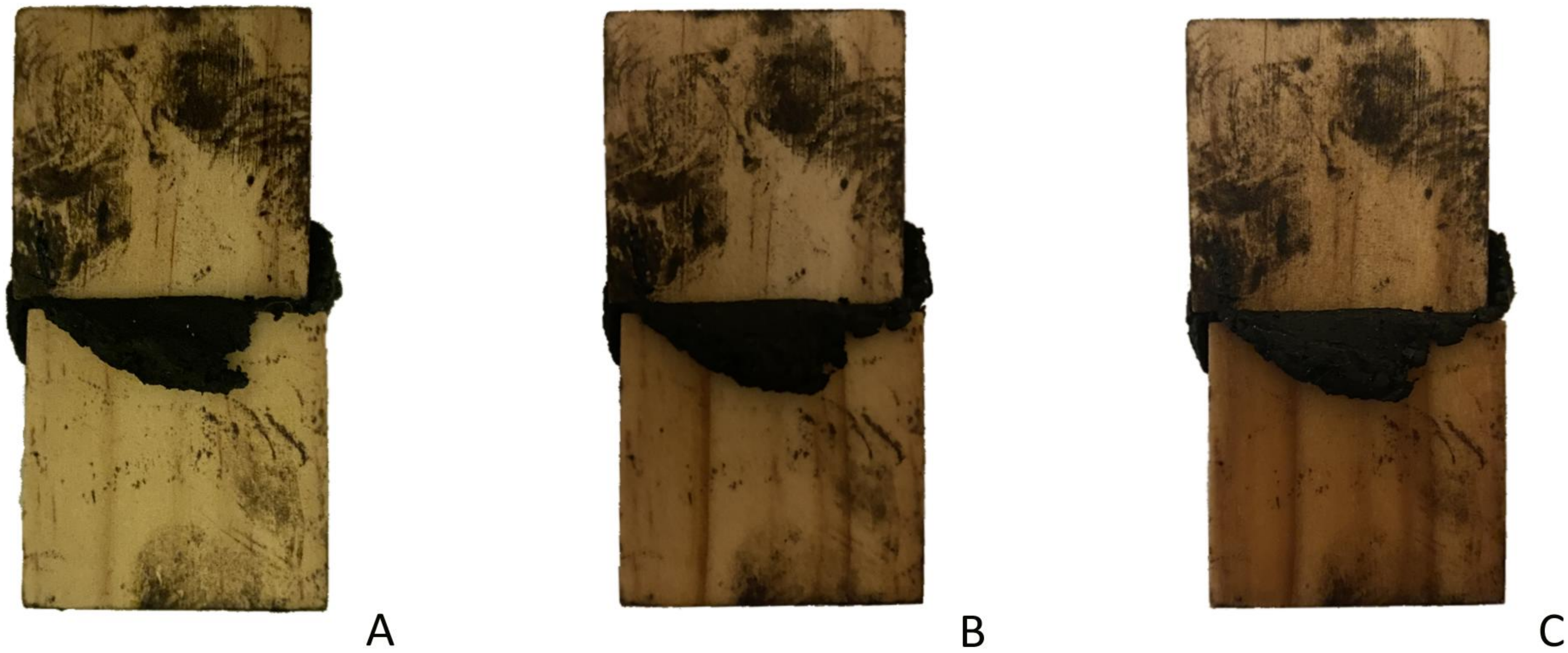


Figure 146. Compound birch bark tar (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

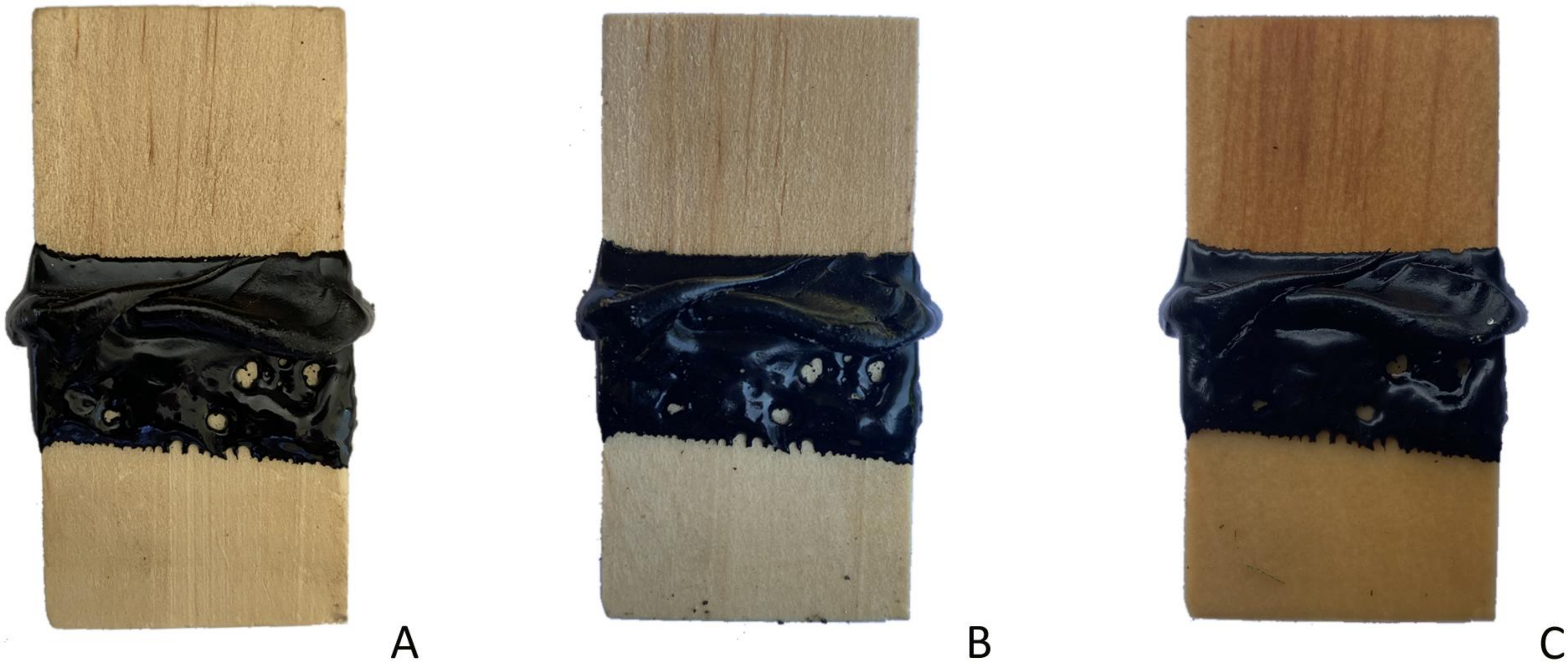


Figure 147. Plain bitumen (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

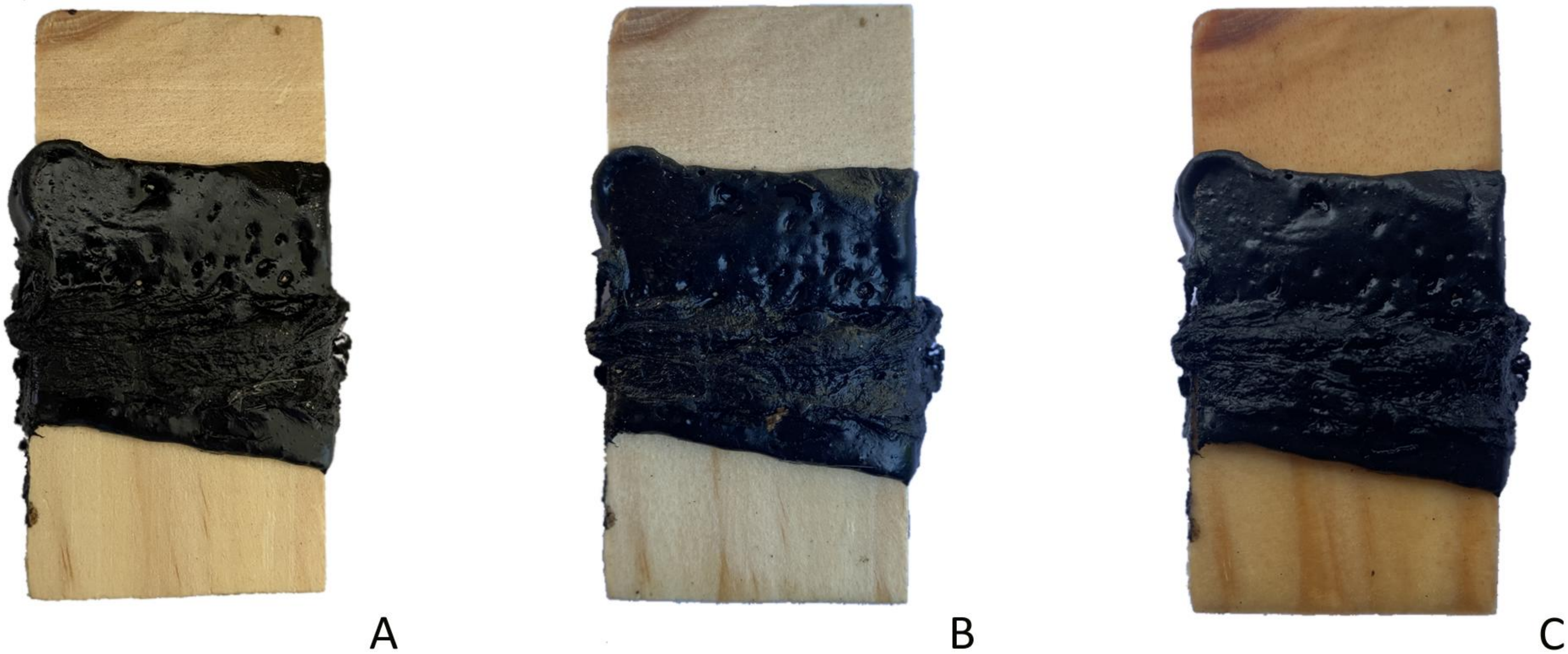


Figure 148. Compound bitumen (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

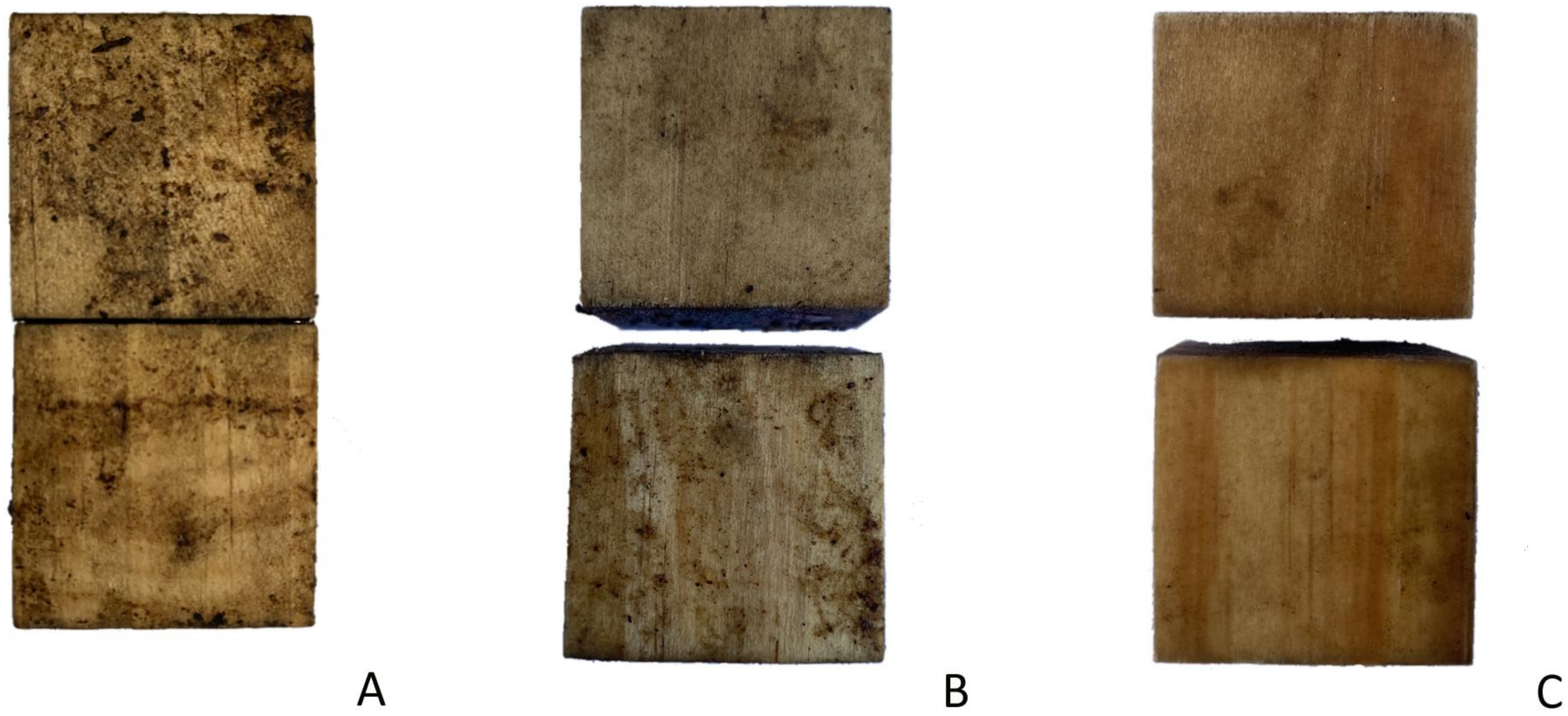


Figure 149. Plain cherry gum (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

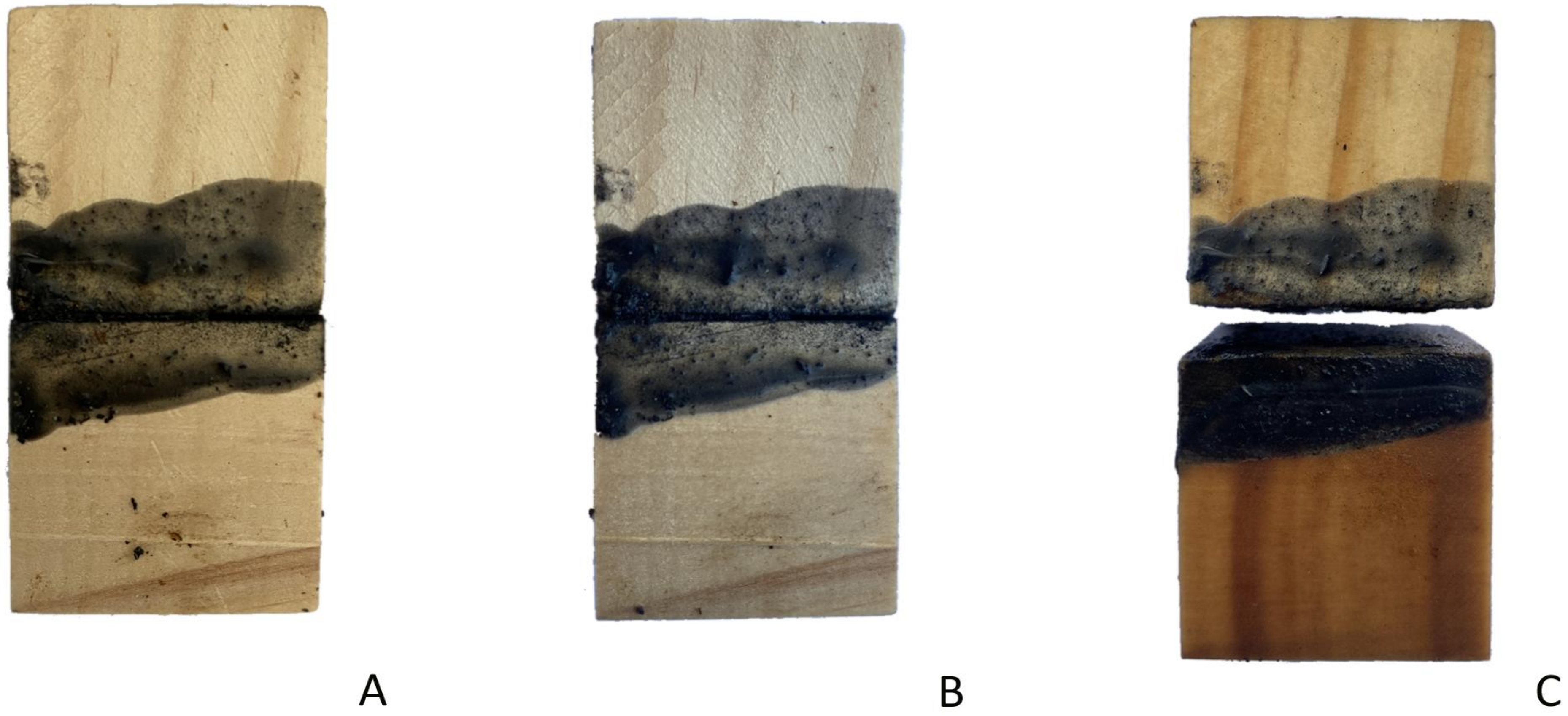


Figure 150. Compound cherry gum (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

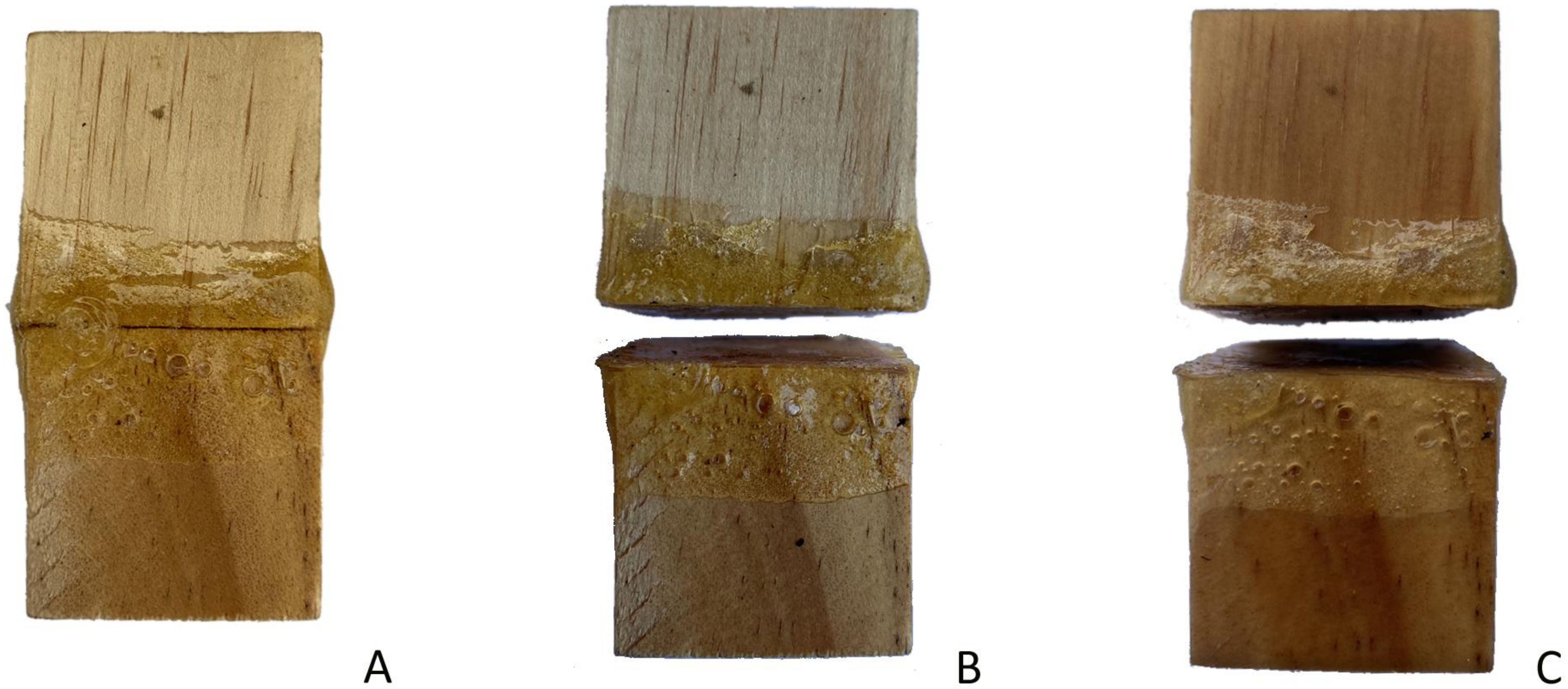


Figure 151. Plain Chios mastic (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

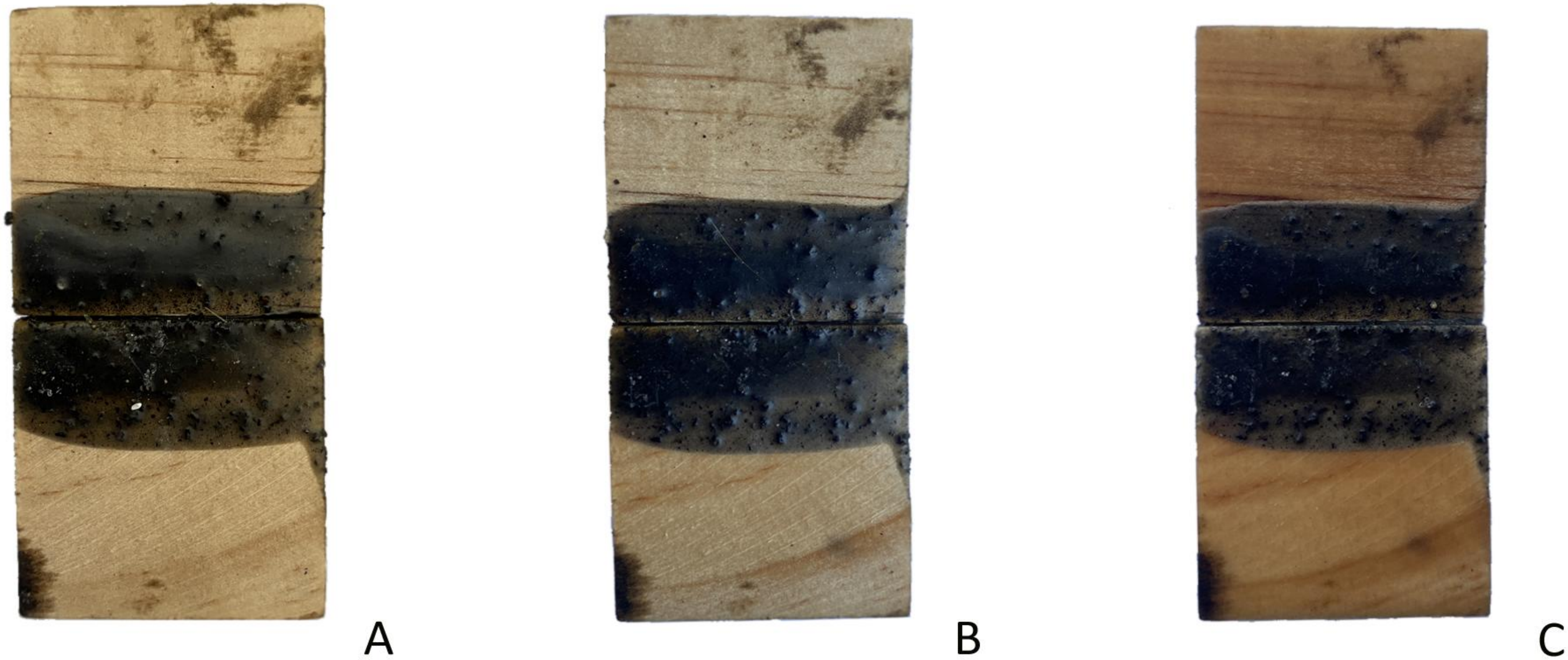


Figure 152. Compound Chios mastic (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

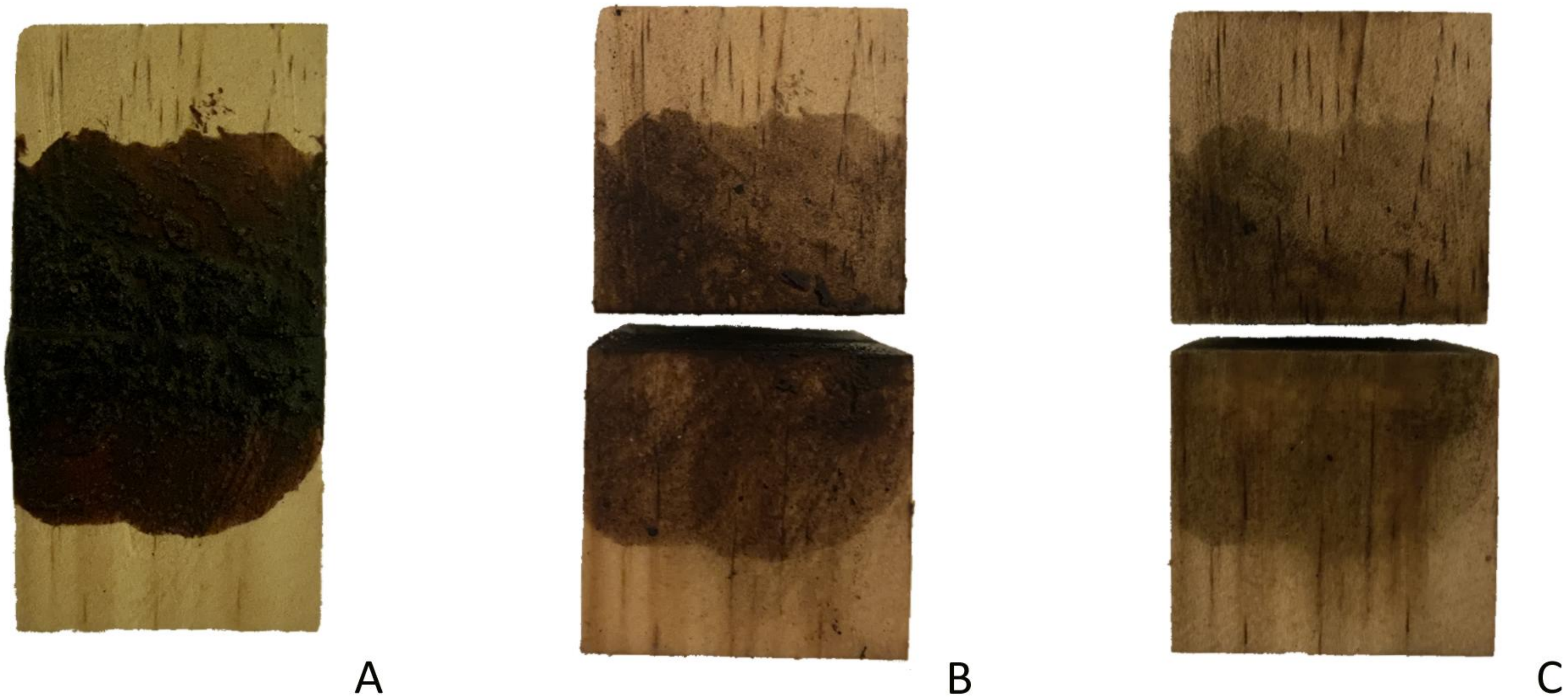


Figure 153. Plain cow blood glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

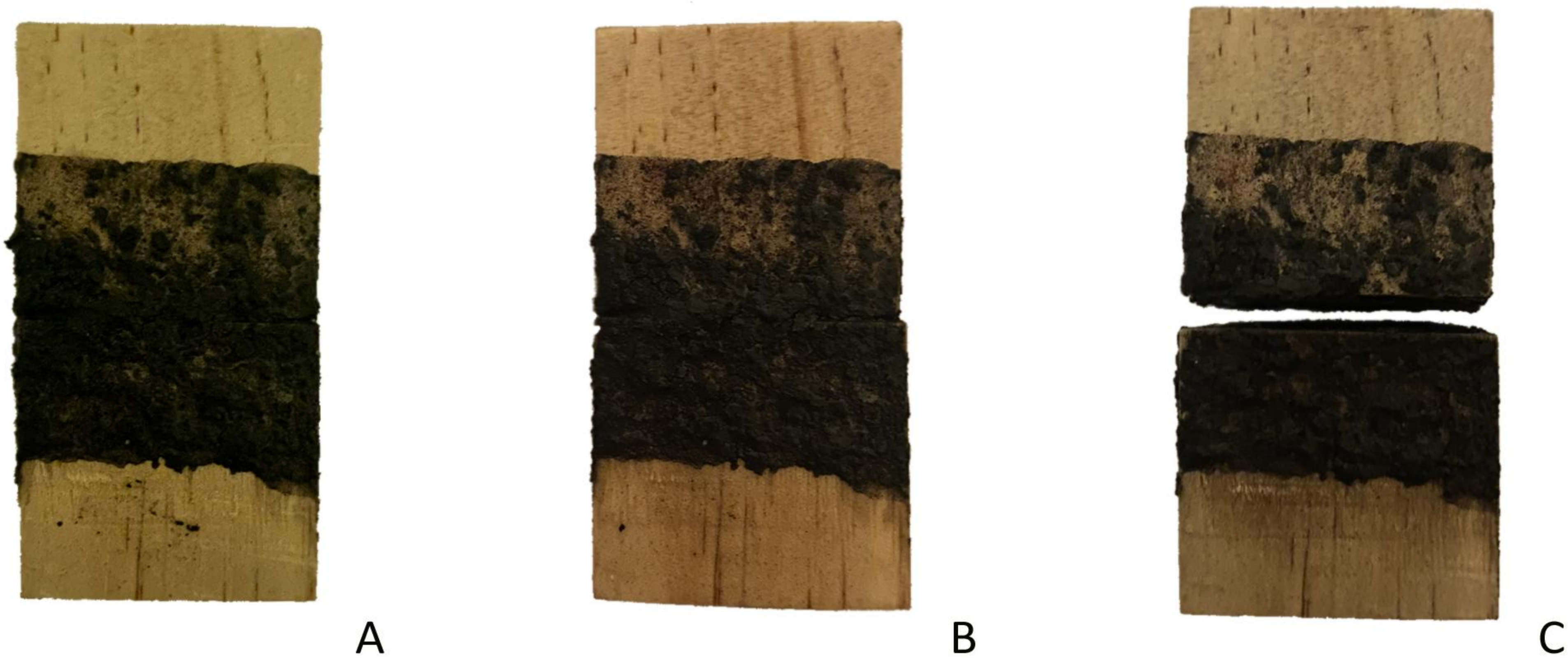


Figure 154. Compound cow blood glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

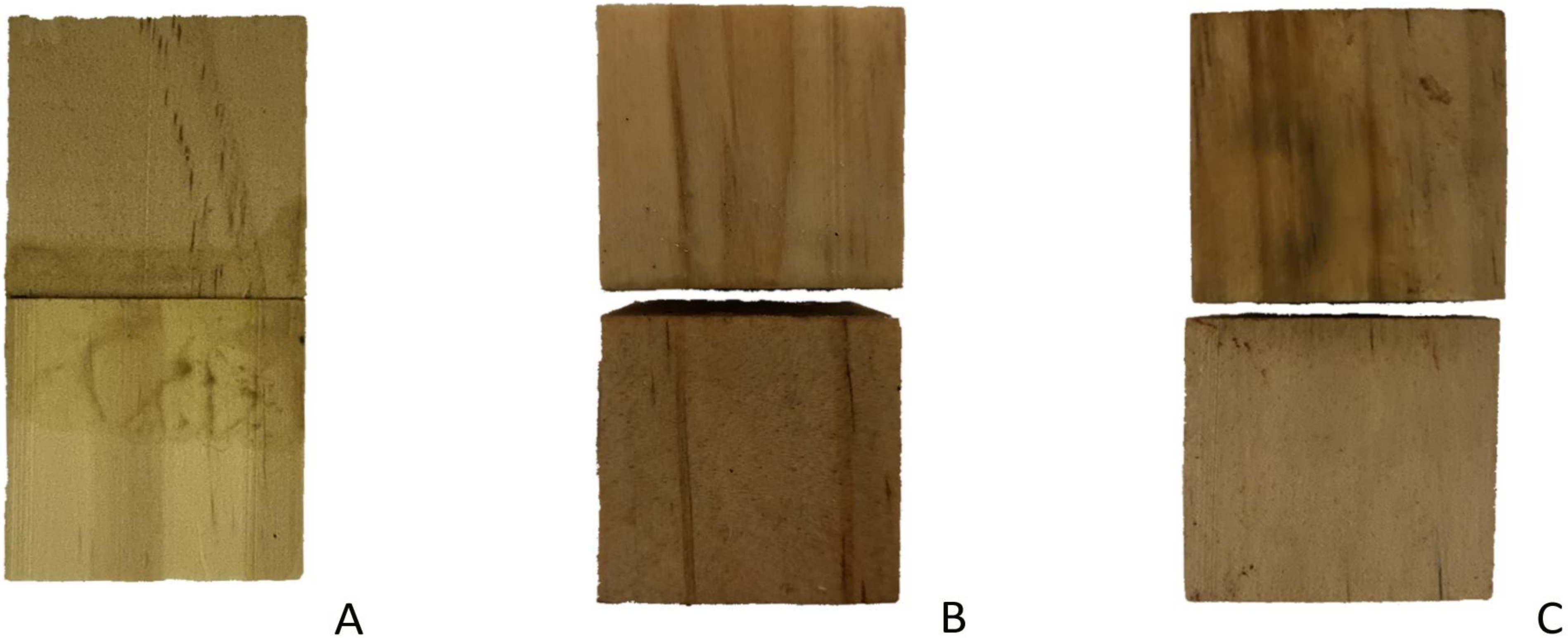


Figure 155. Plain deer bone glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

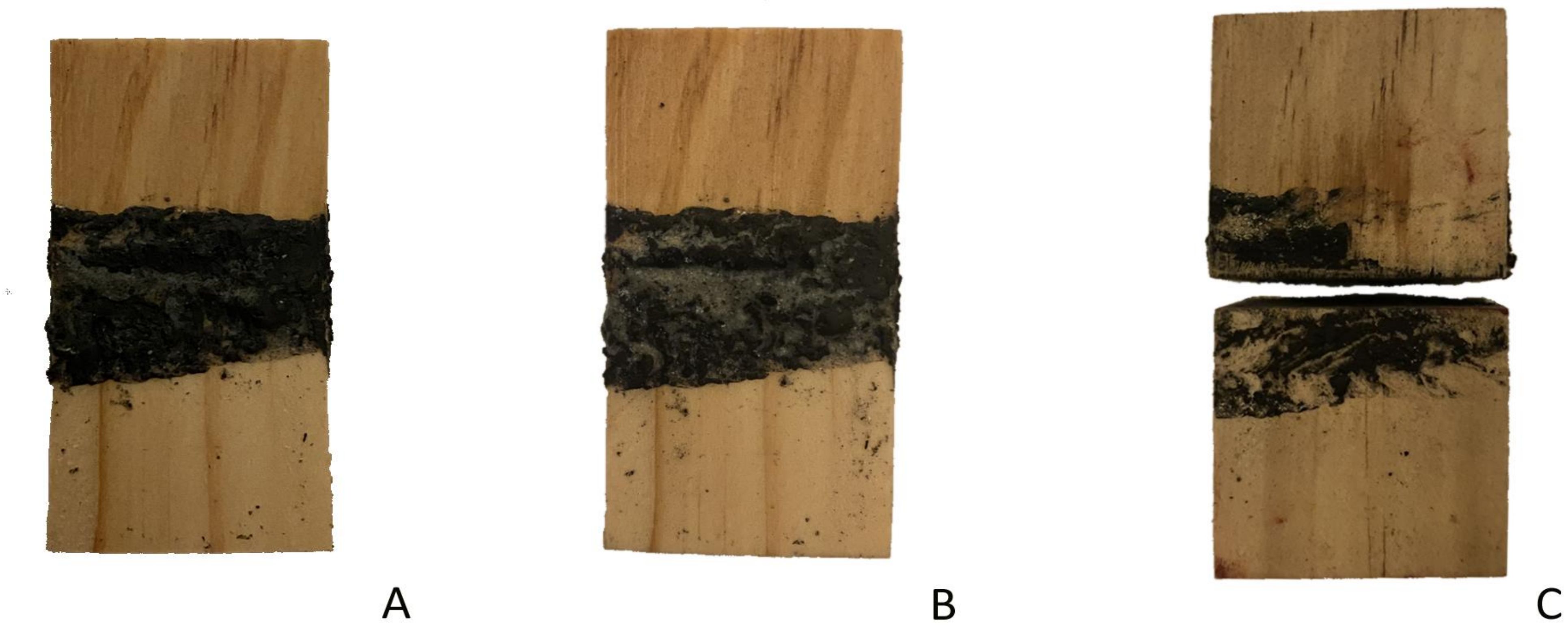


Figure 156. Compound deer bone glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

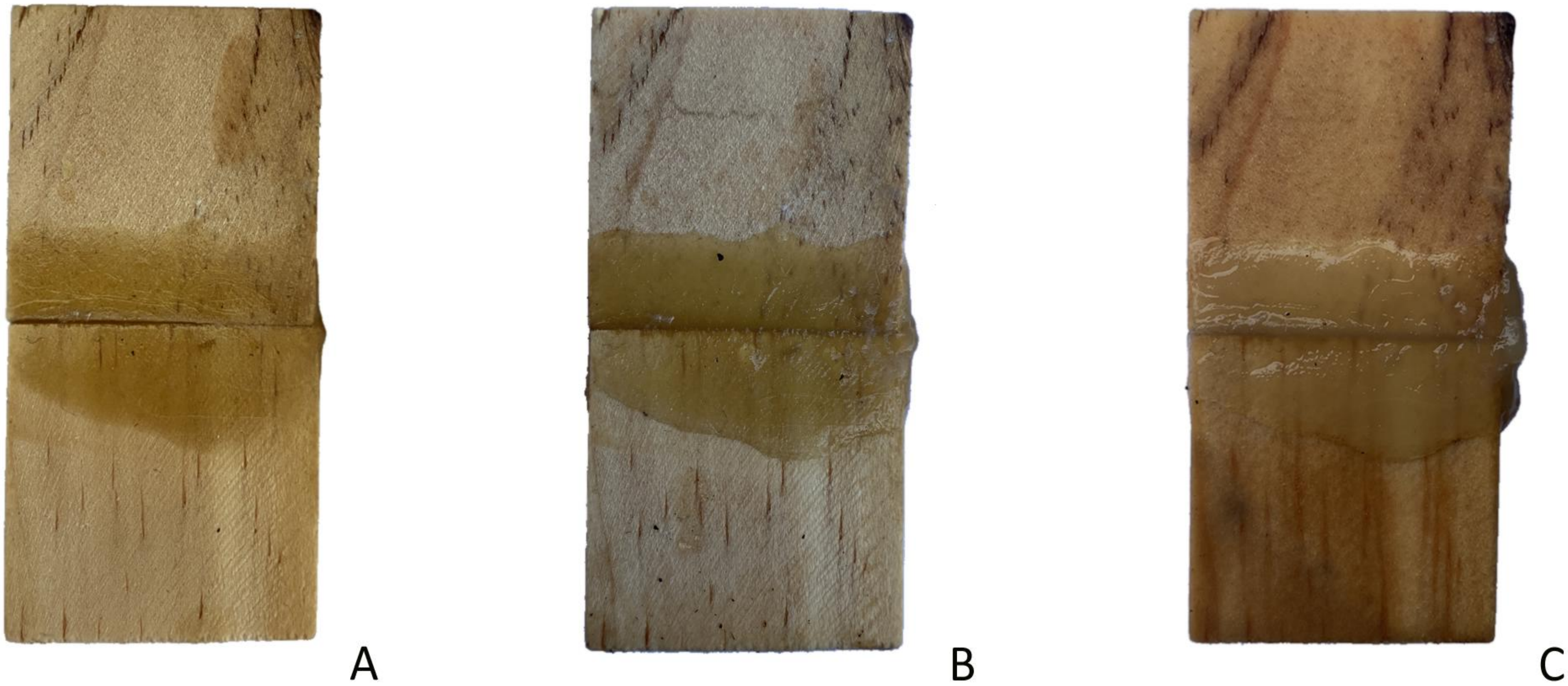


Figure 157. Plain deer hide glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

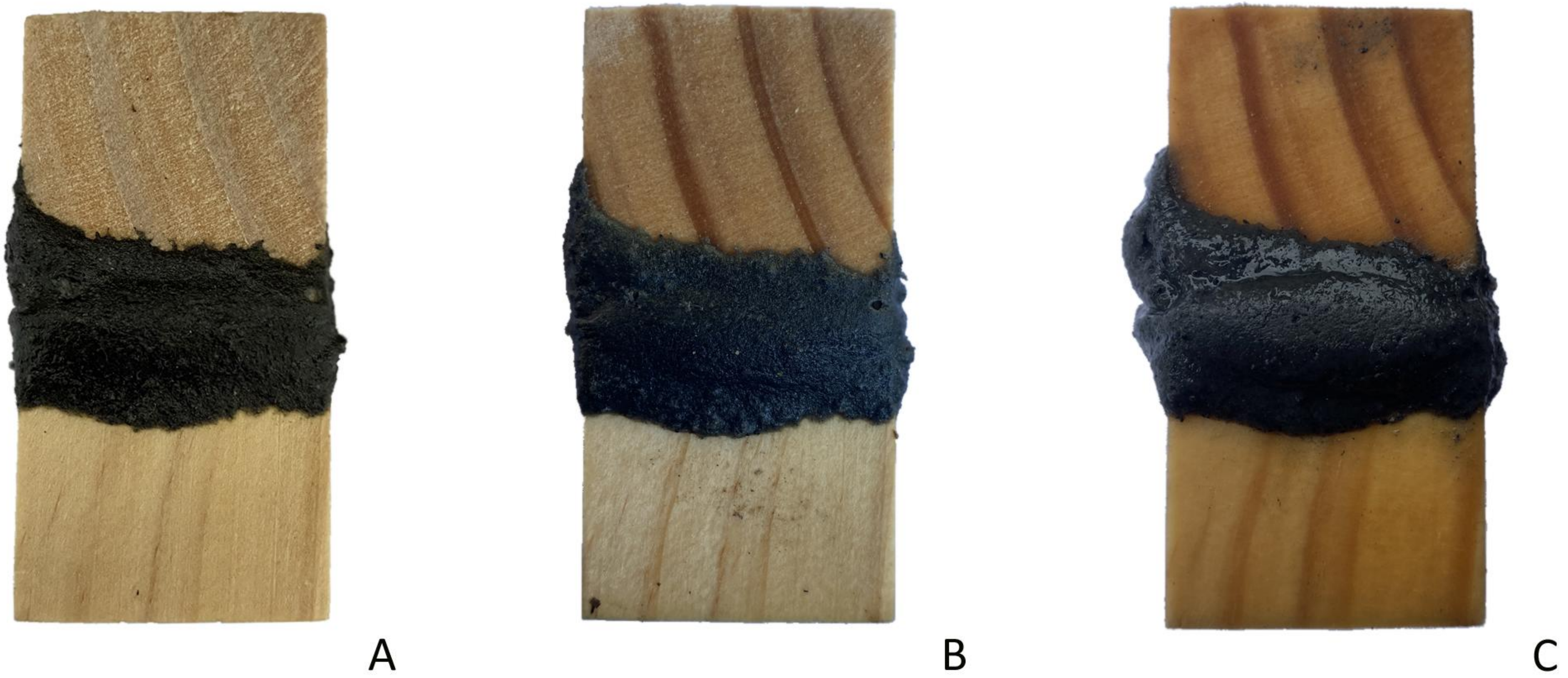


Figure 158. Compound deer hide glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

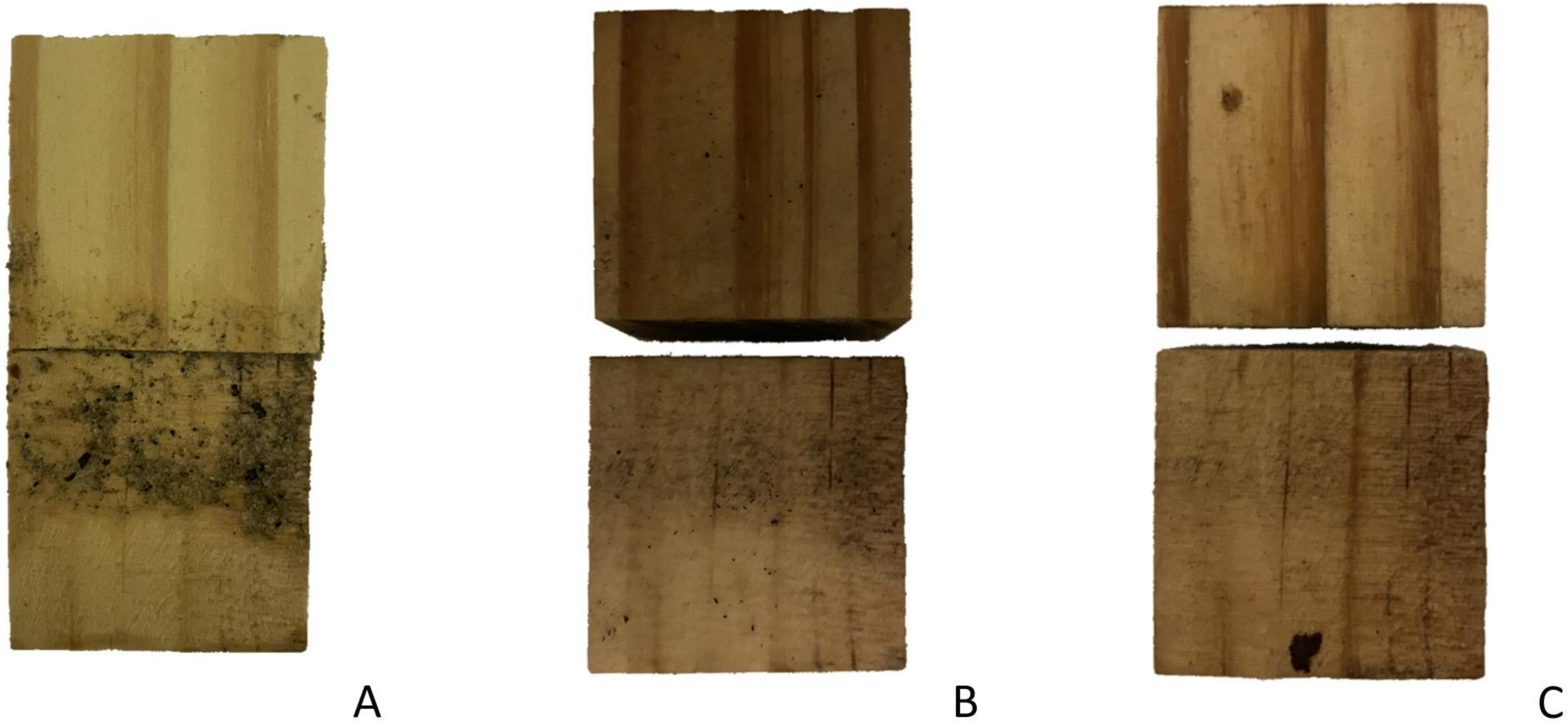


Figure 159. Plain egg white glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

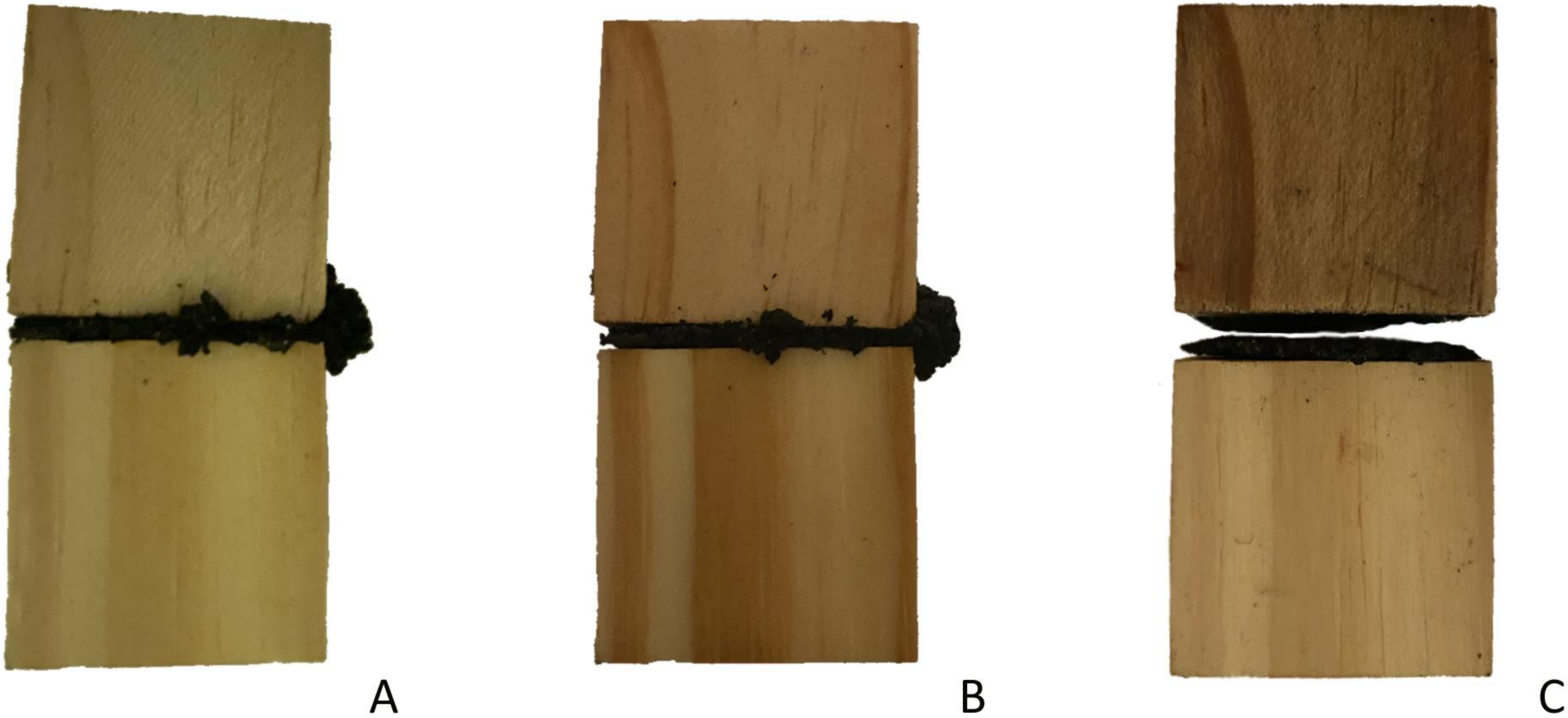


Figure 160. Compound egg white glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

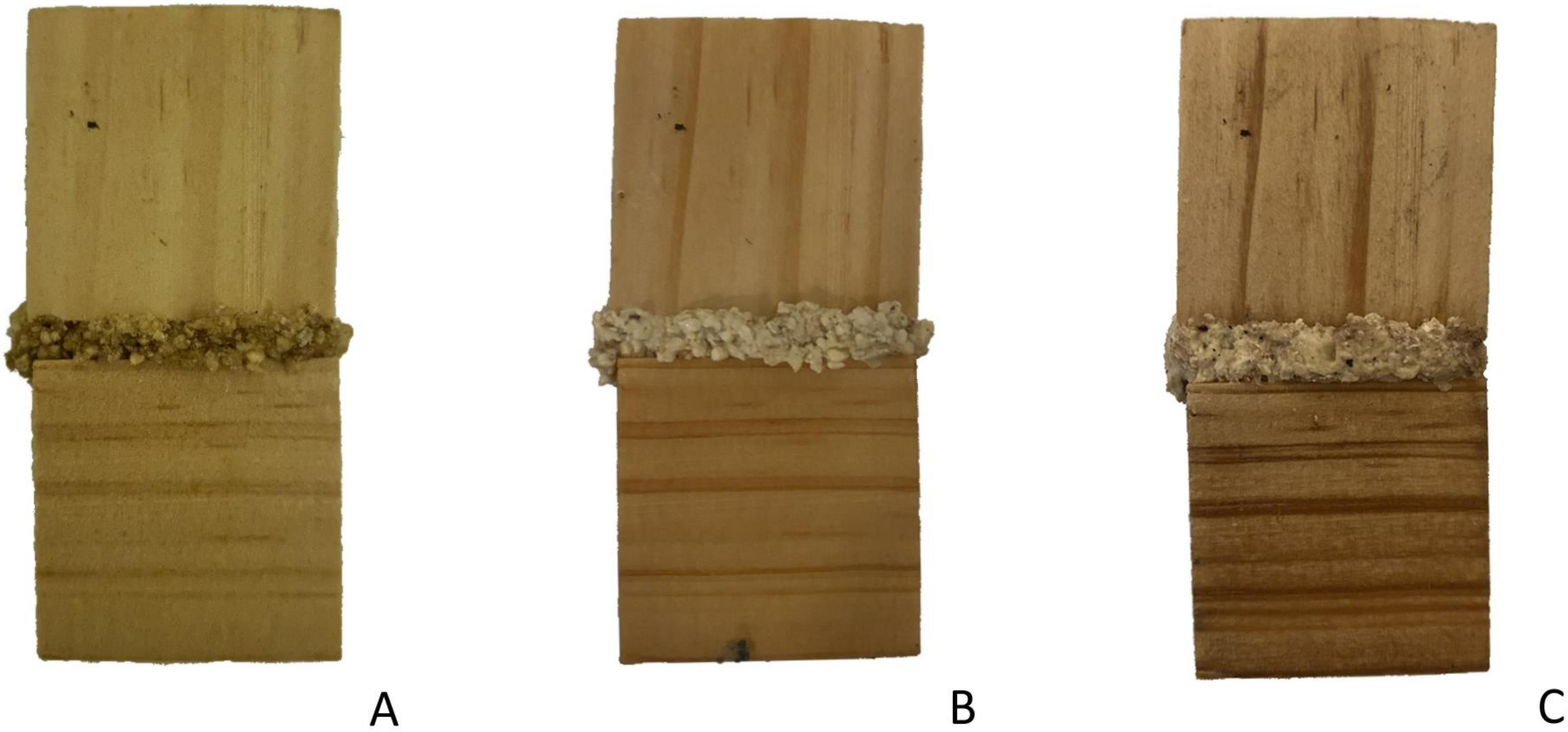


Figure 161. Plain frankincense (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

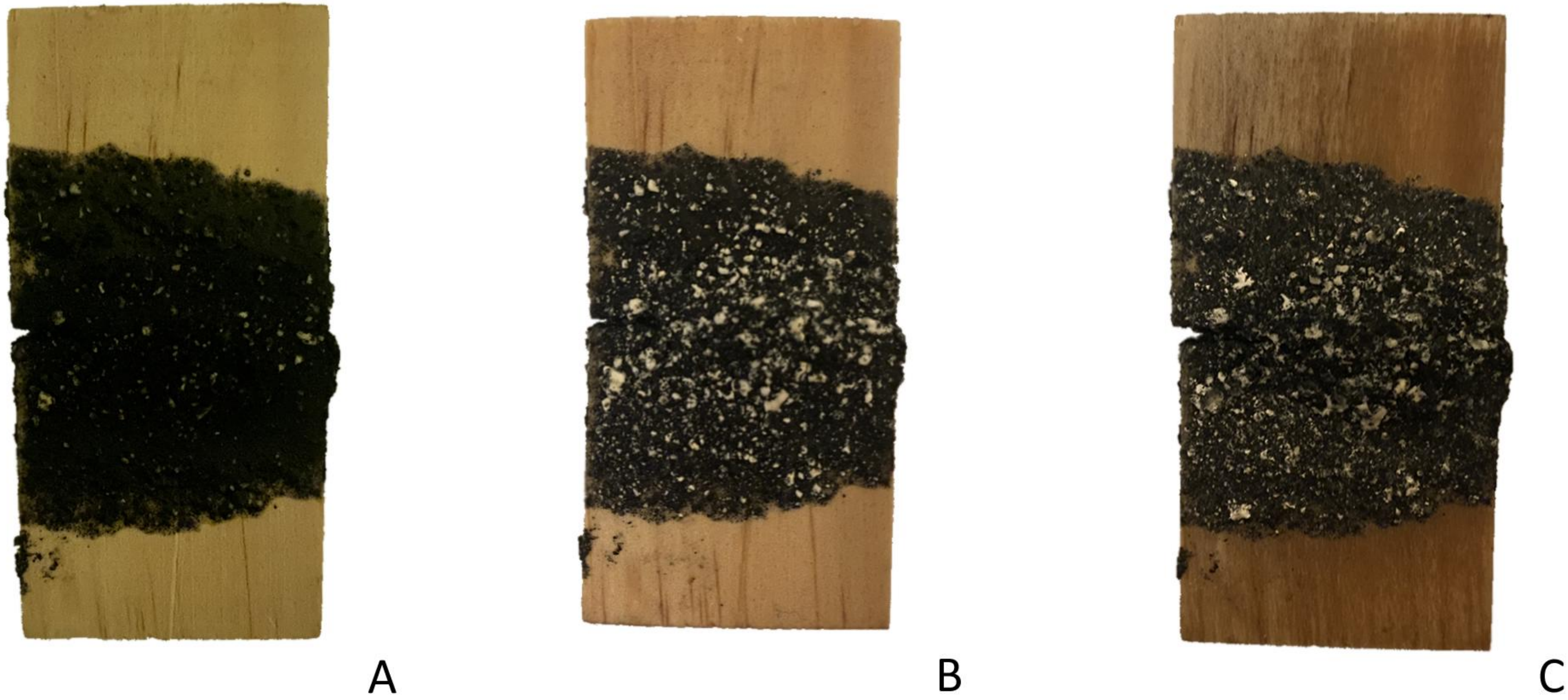


Figure 162. Compound frankincense (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

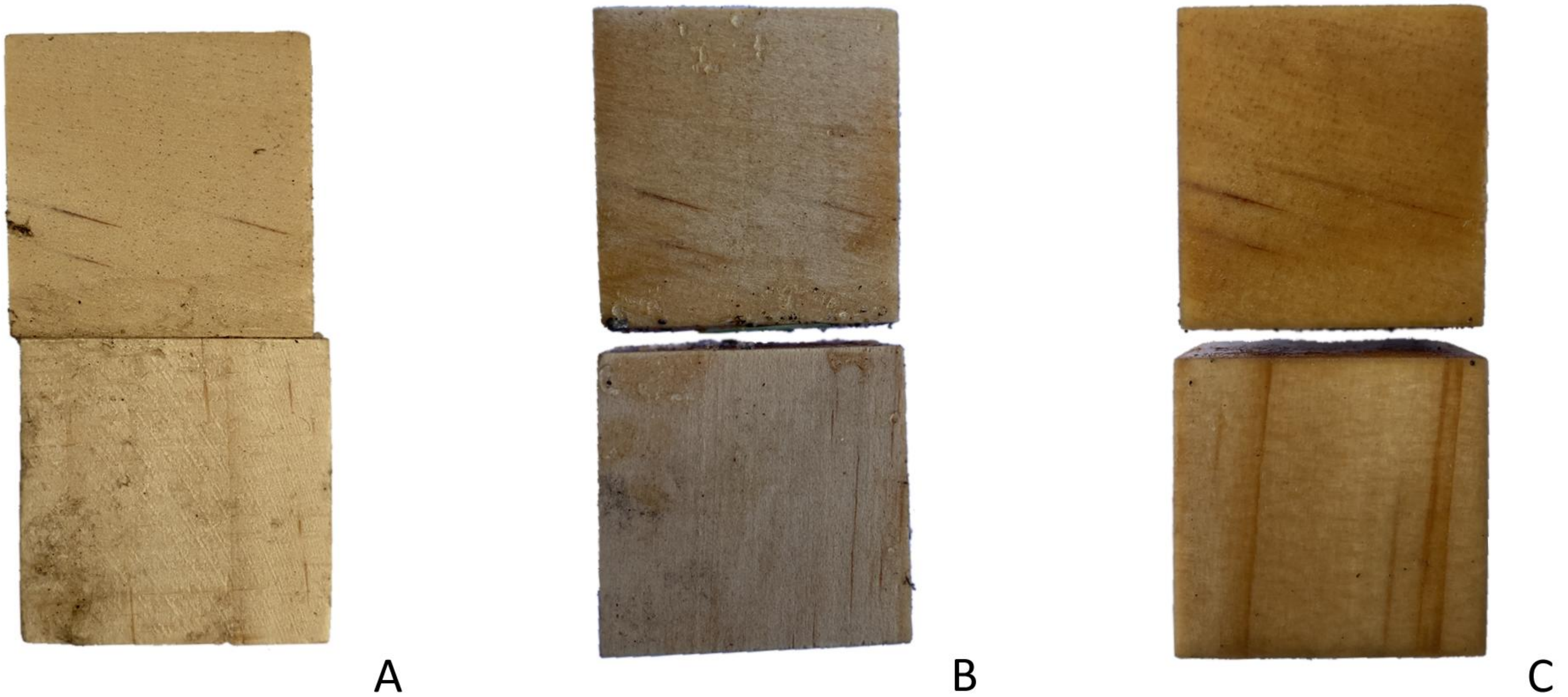


Figure 163. Plain gum tragacanth (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

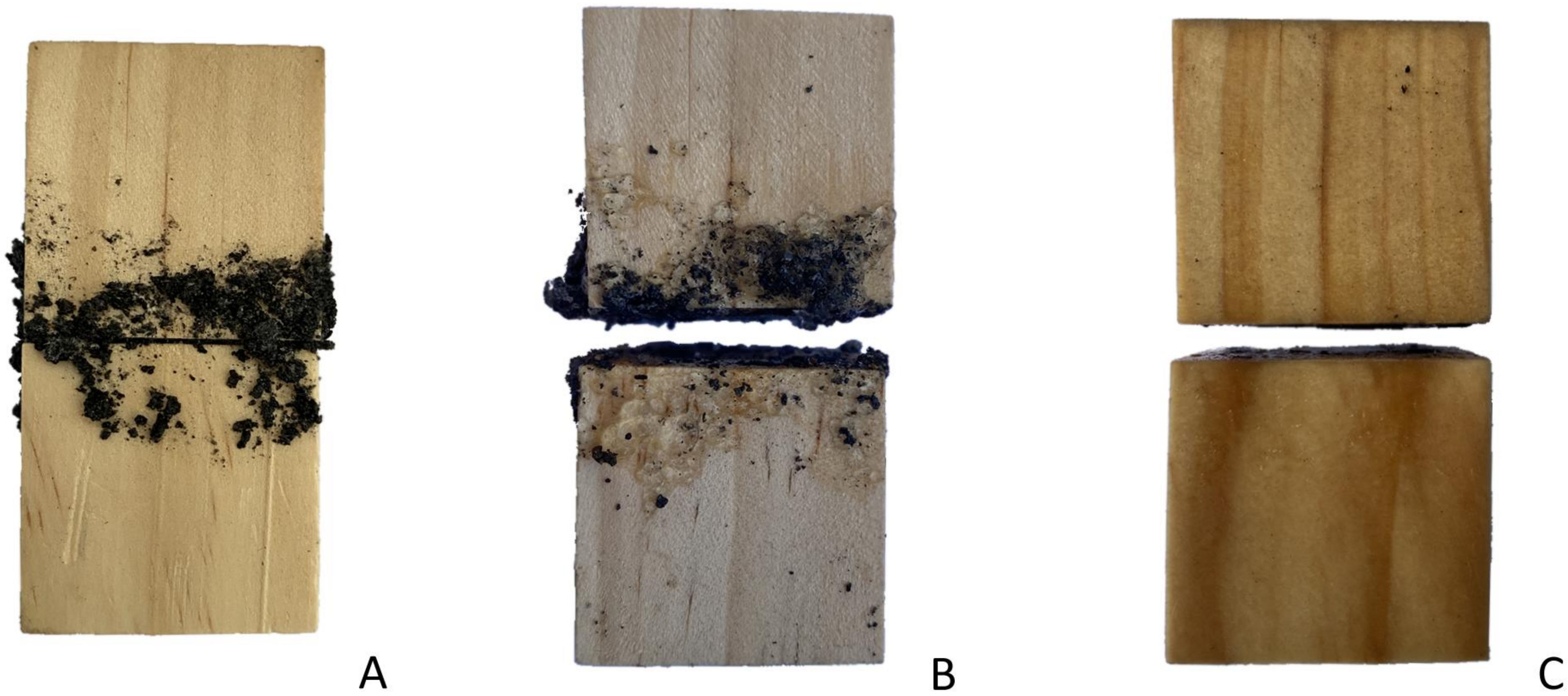


Figure 164. Compound gum tragacanth (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

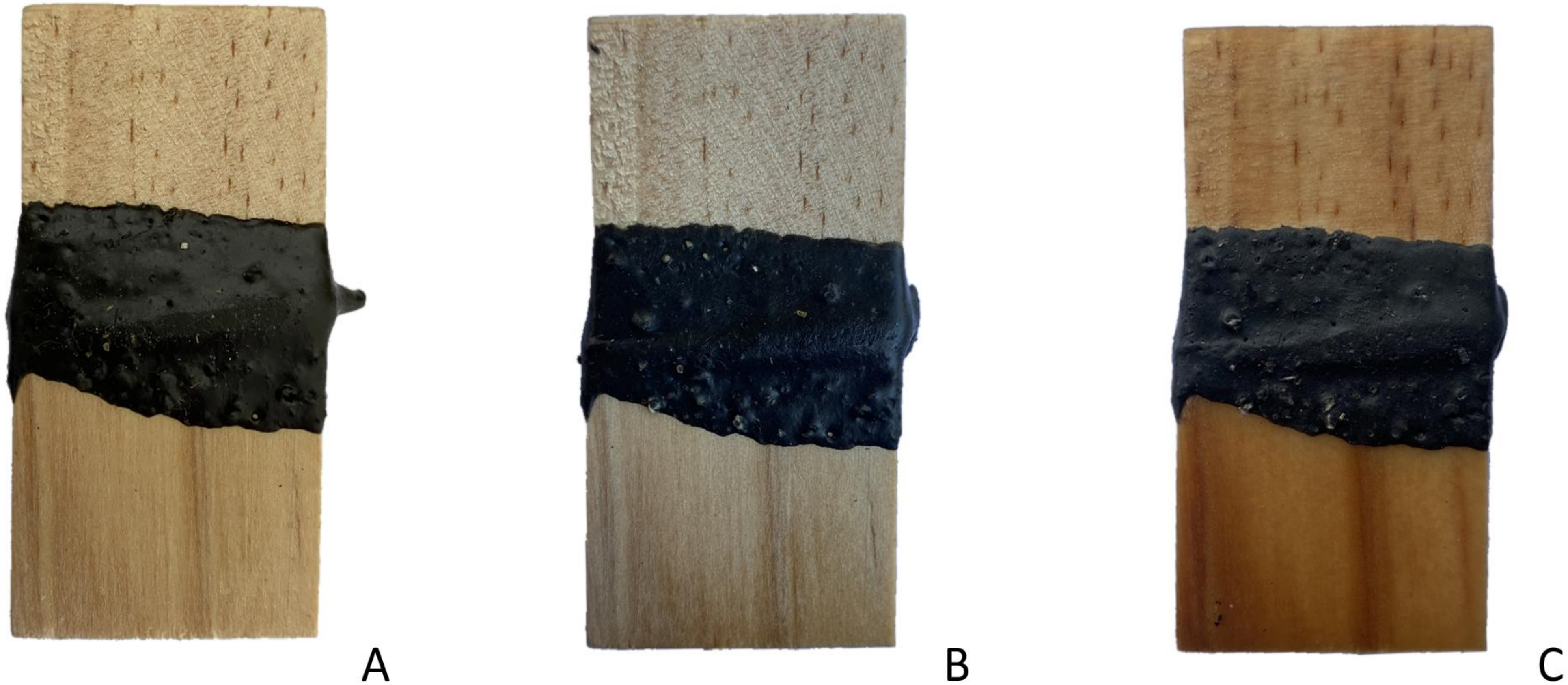


Figure 165. Plain labdanum (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

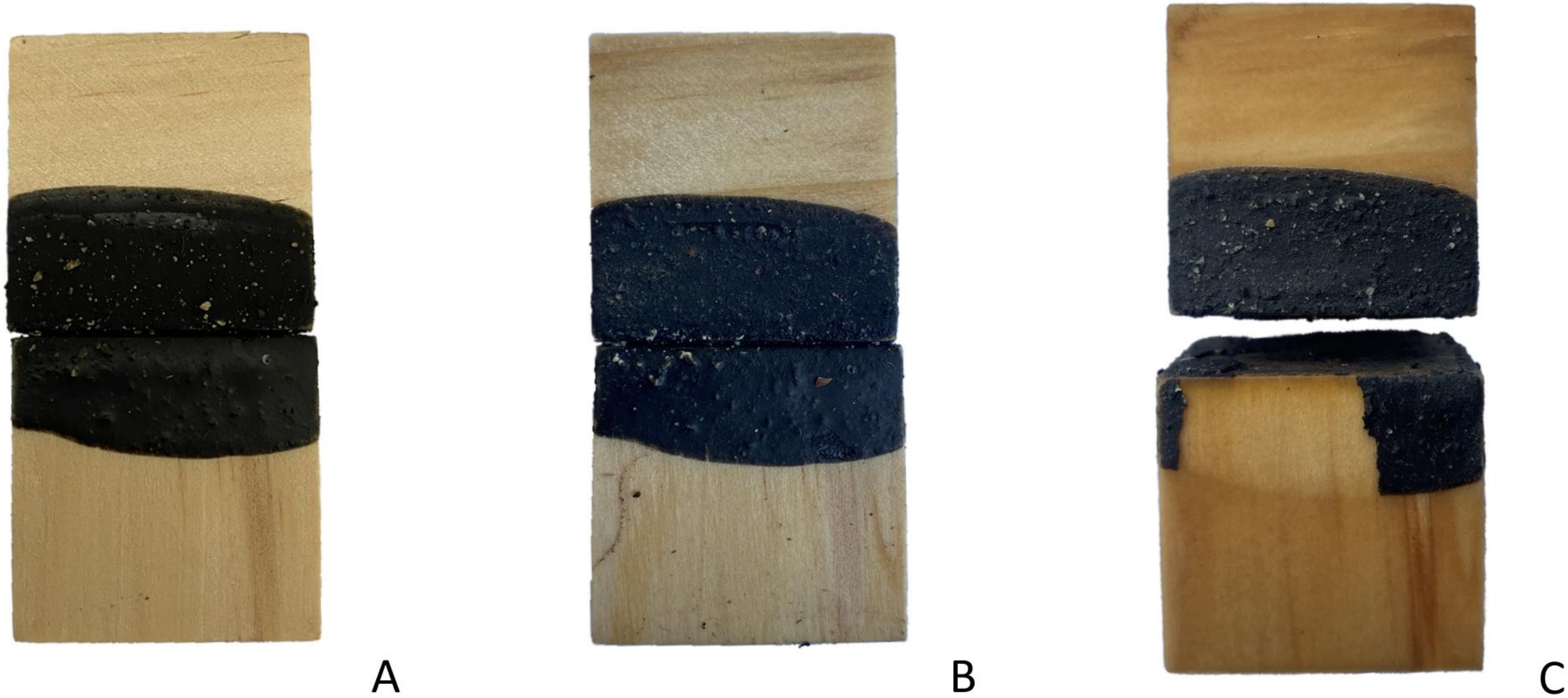


Figure 166. Compound labdanum (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

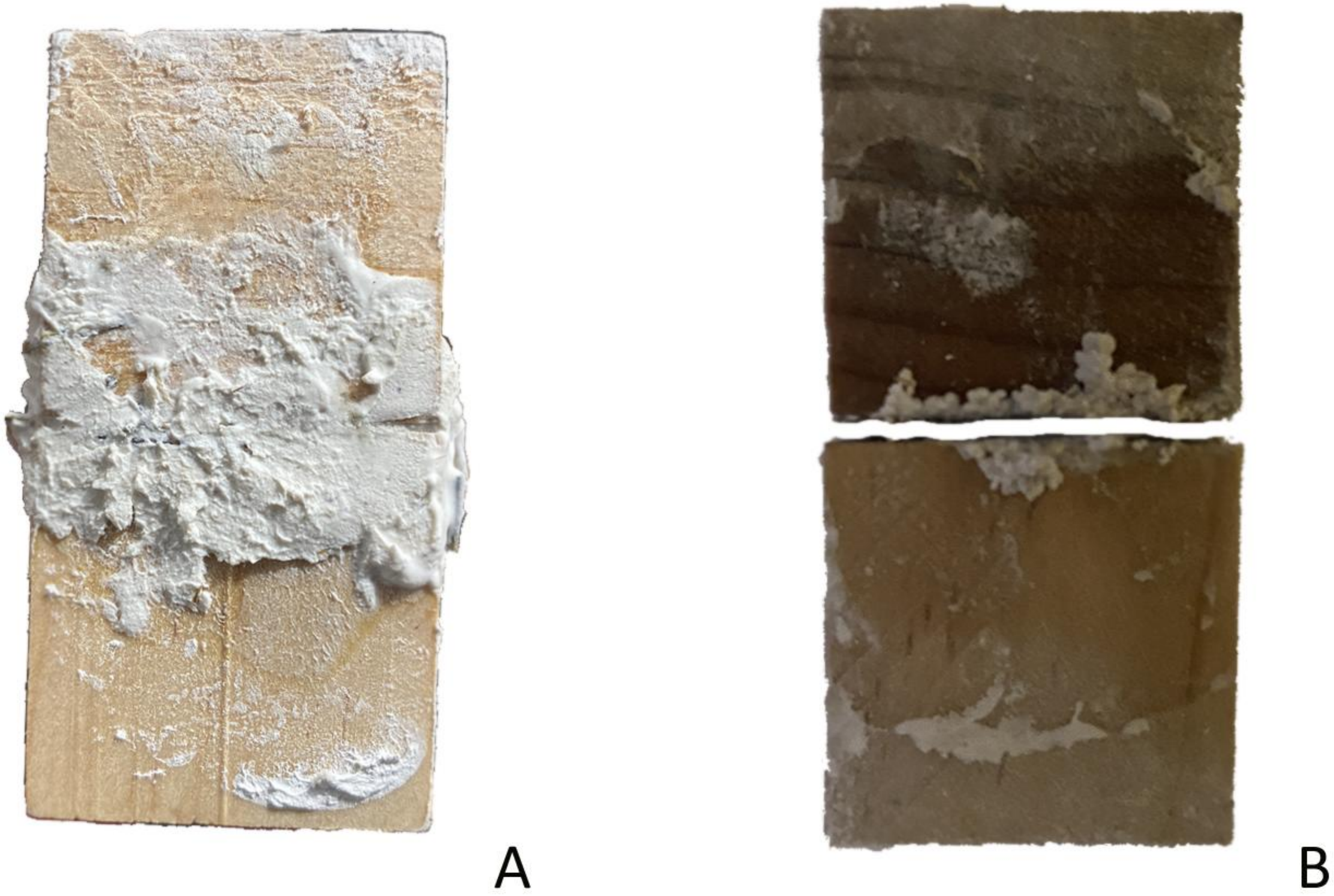


Figure 167. Plain lime plaster (A) before water exposure and (B) after 15 minutes.

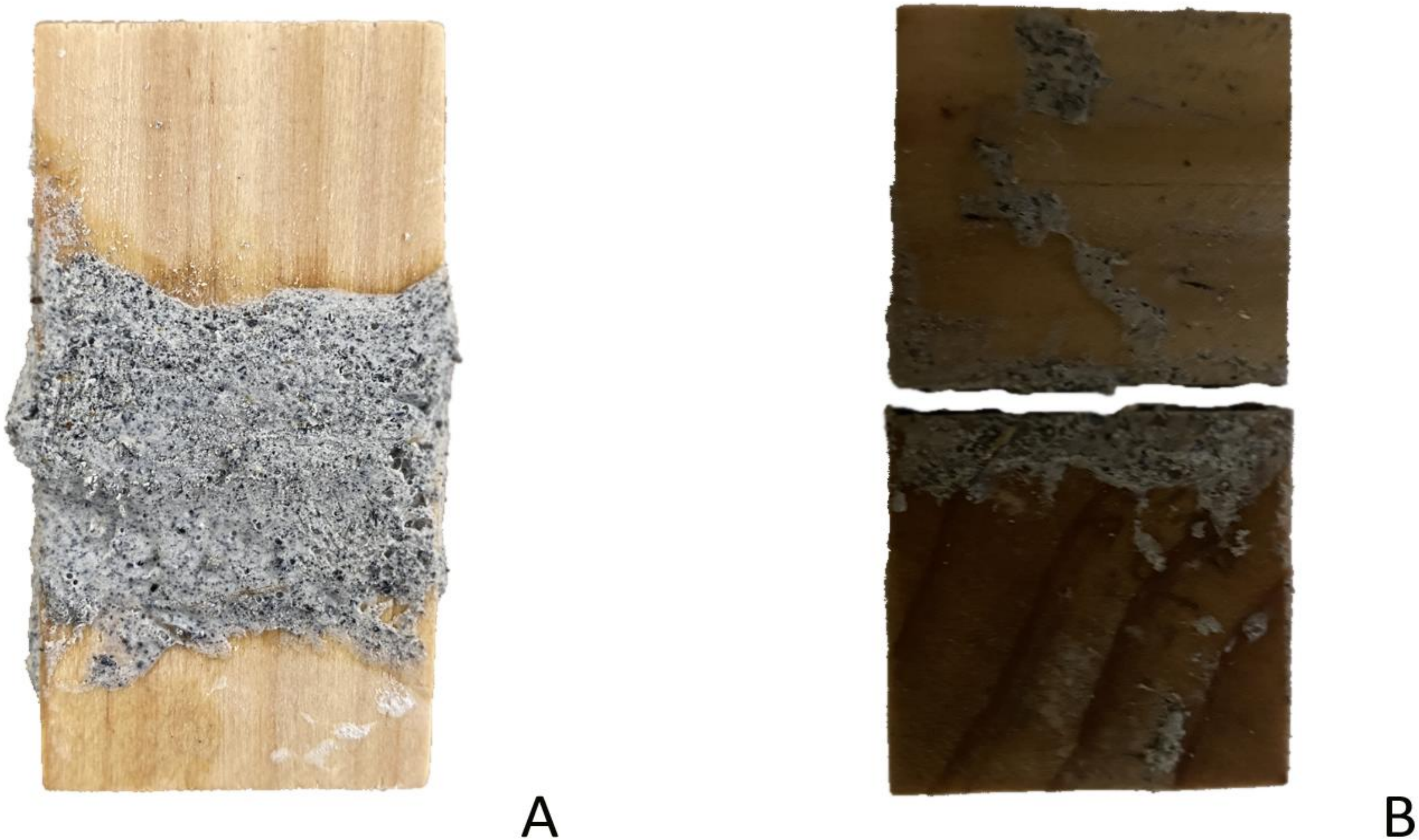


Figure 168. Compound lime plaster (A) before water exposure and (B) after 15 minutes.

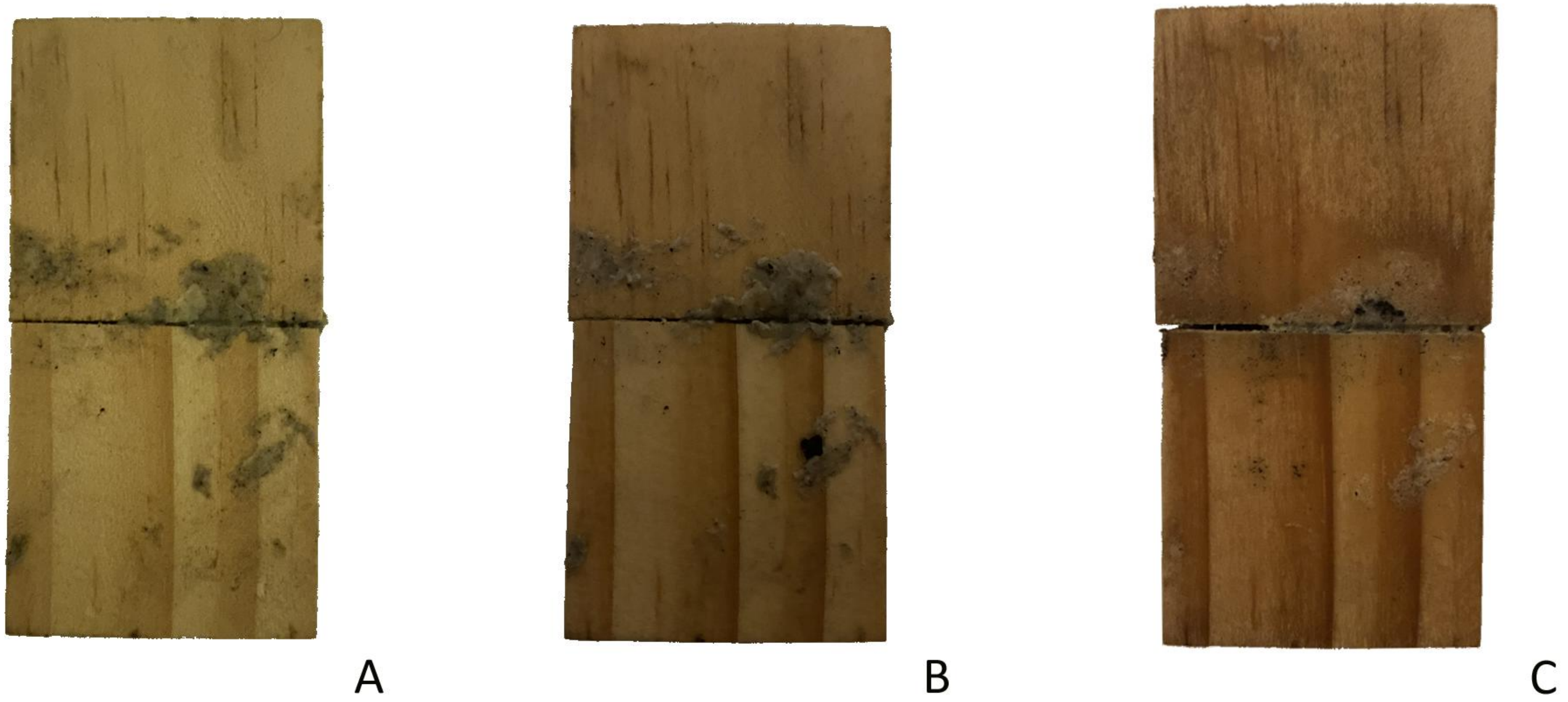


Figure 169. Plain milk casein glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

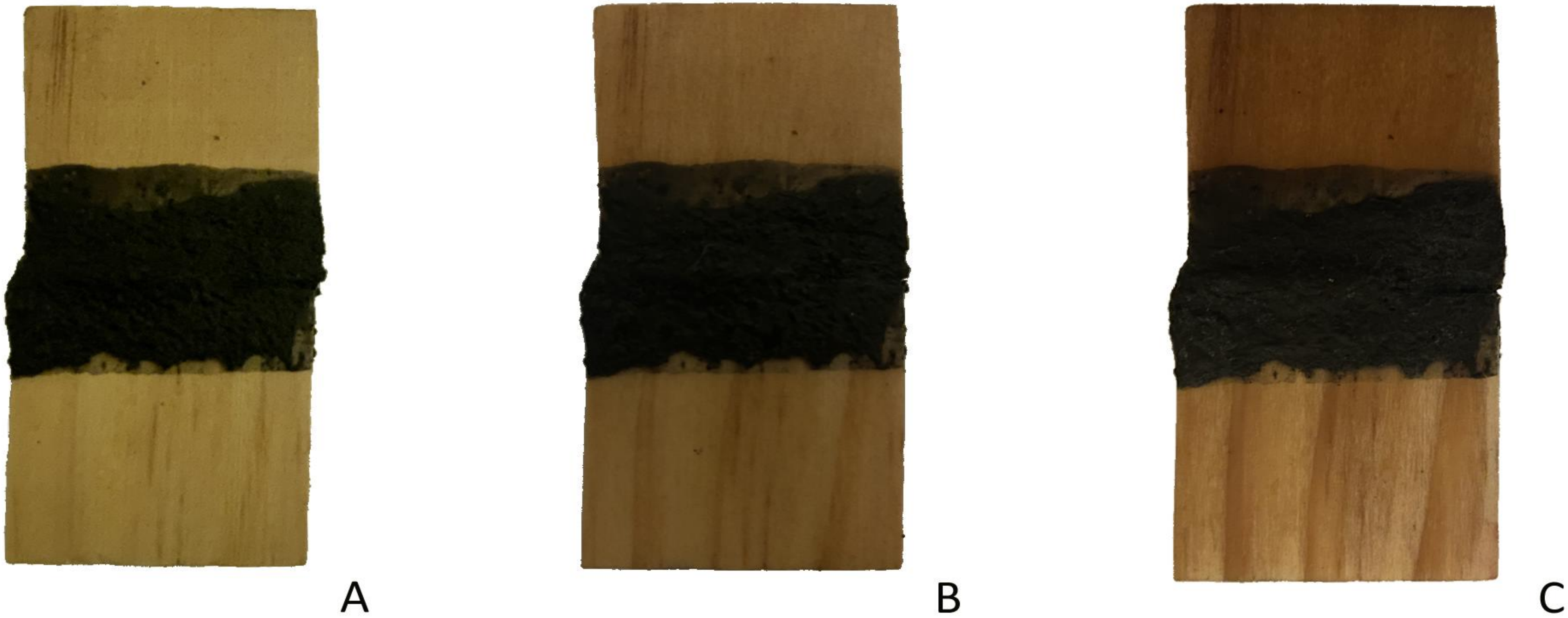


Figure 170. Compound milk casein glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

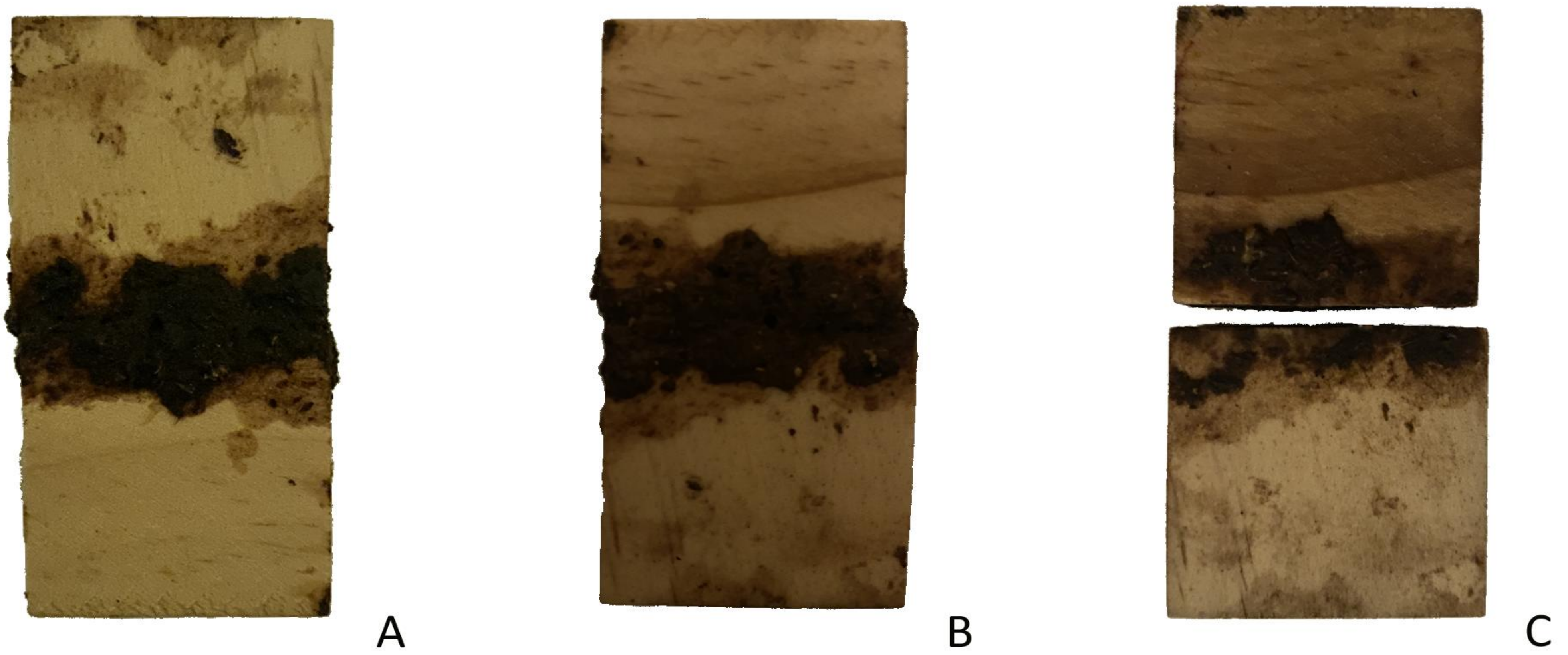


Figure 171. Plain myrrh (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

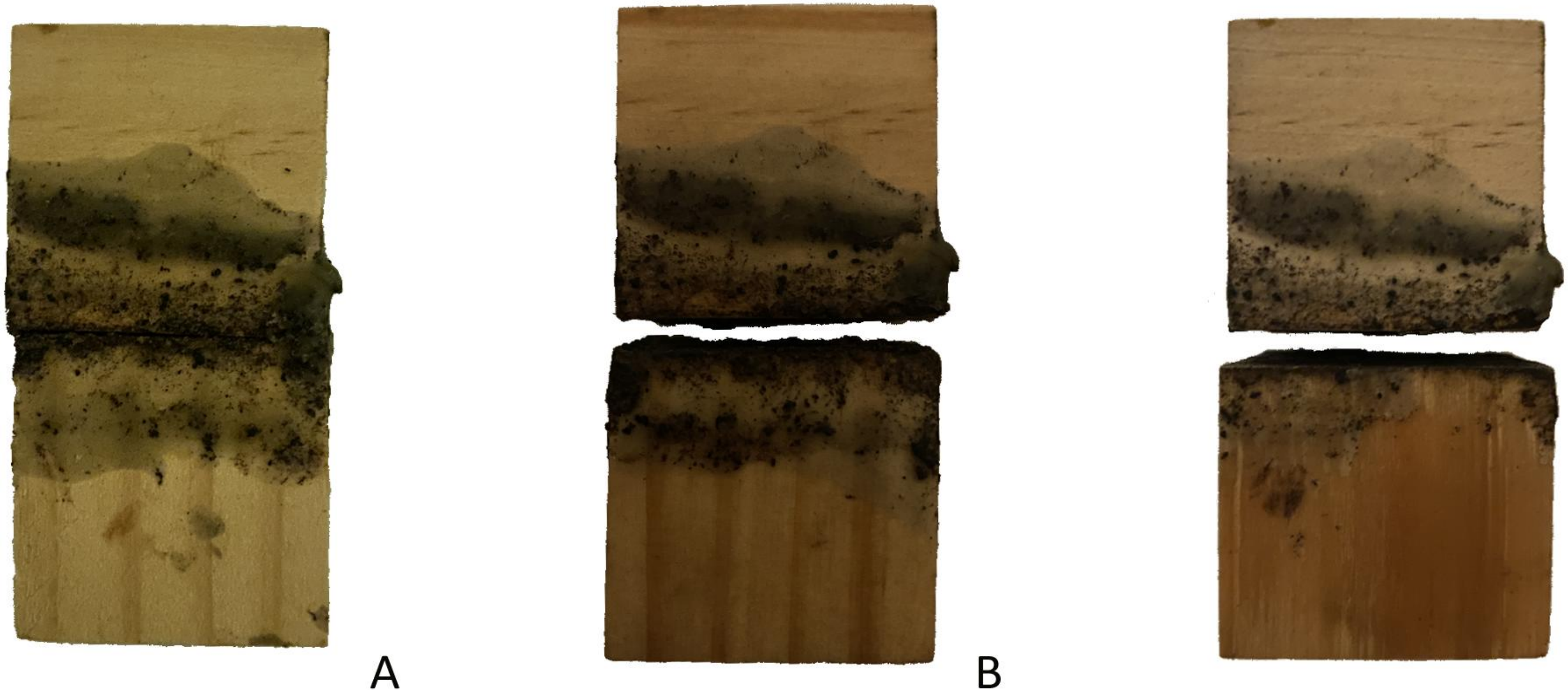


Figure 172. Compound myrrh (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

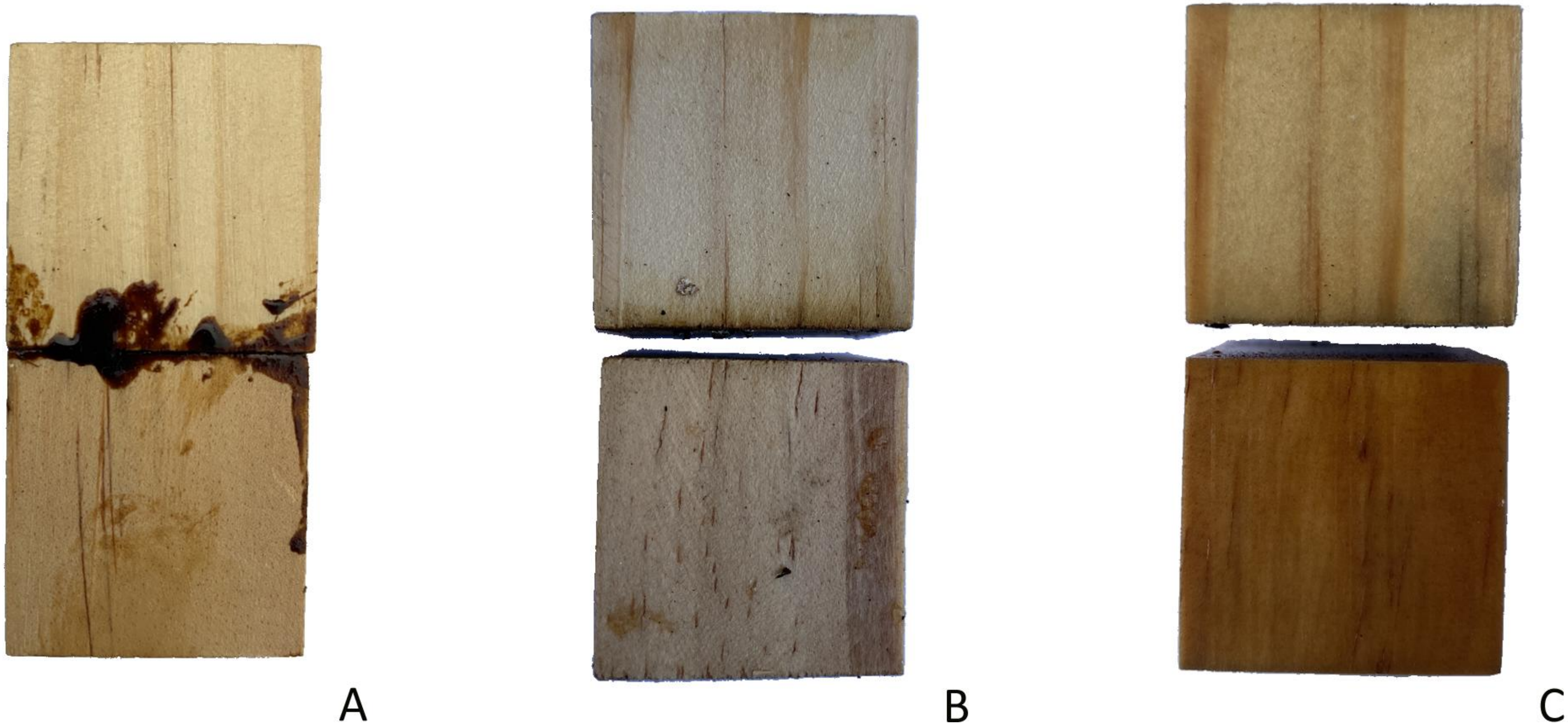


Figure 173. Plain nettle latex (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

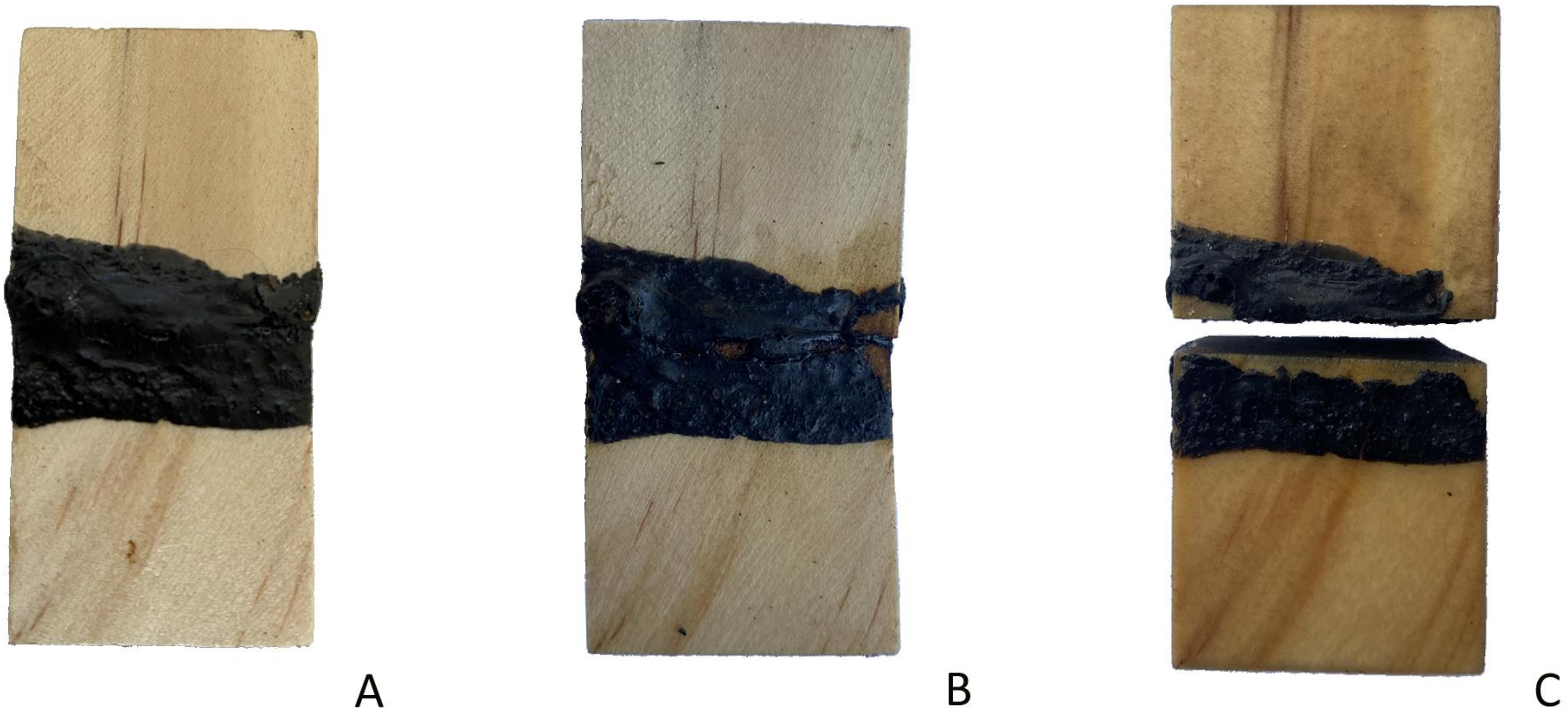


Figure 174. Compound nettle latex (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

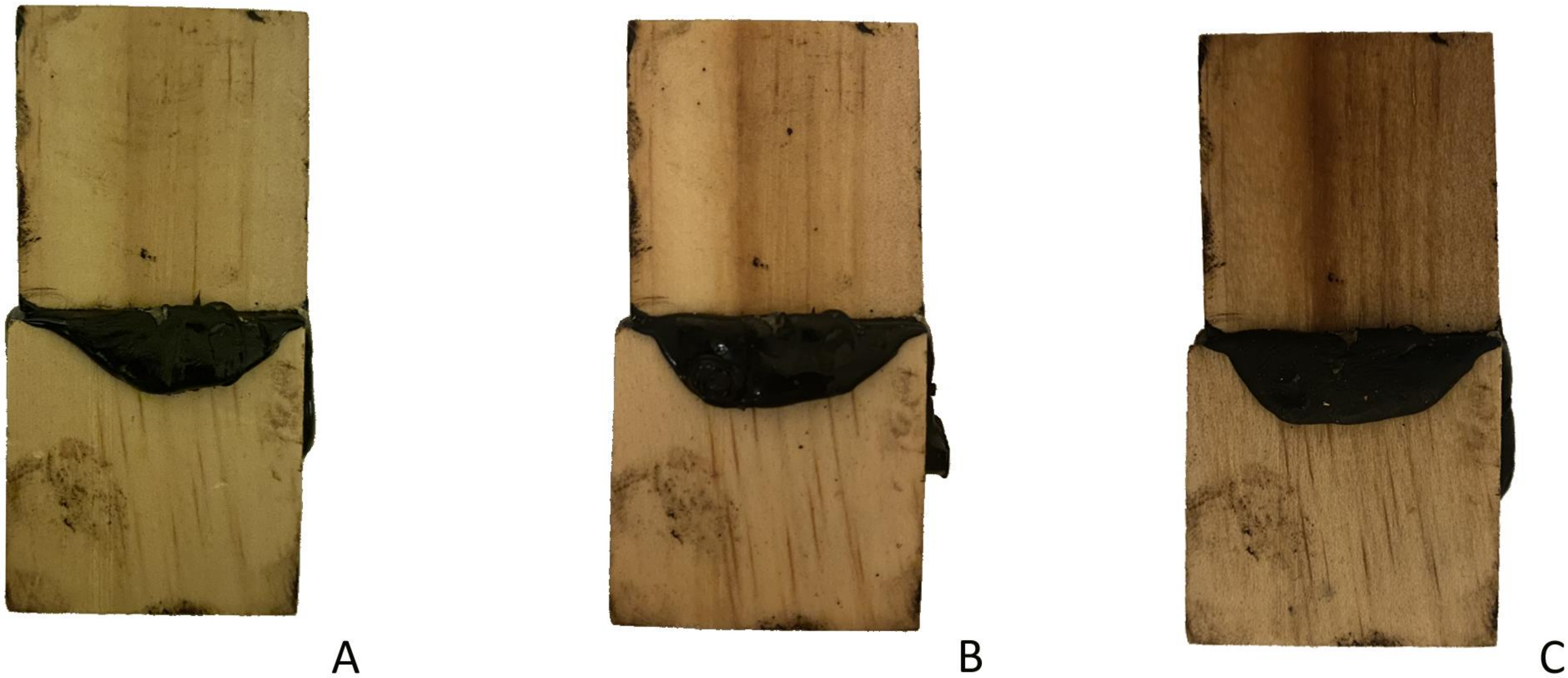


Figure 175. Plain pine bark tar (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

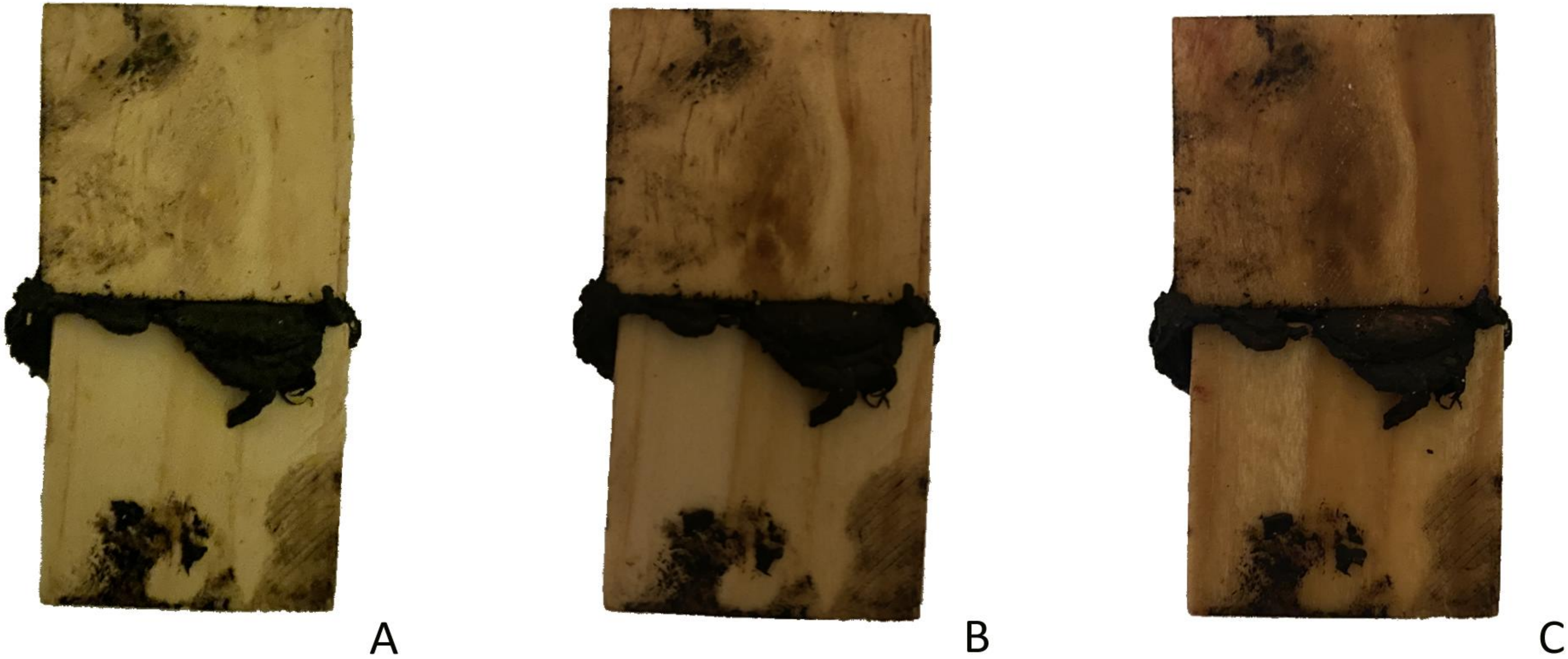


Figure 176. Compound pine bark tar (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

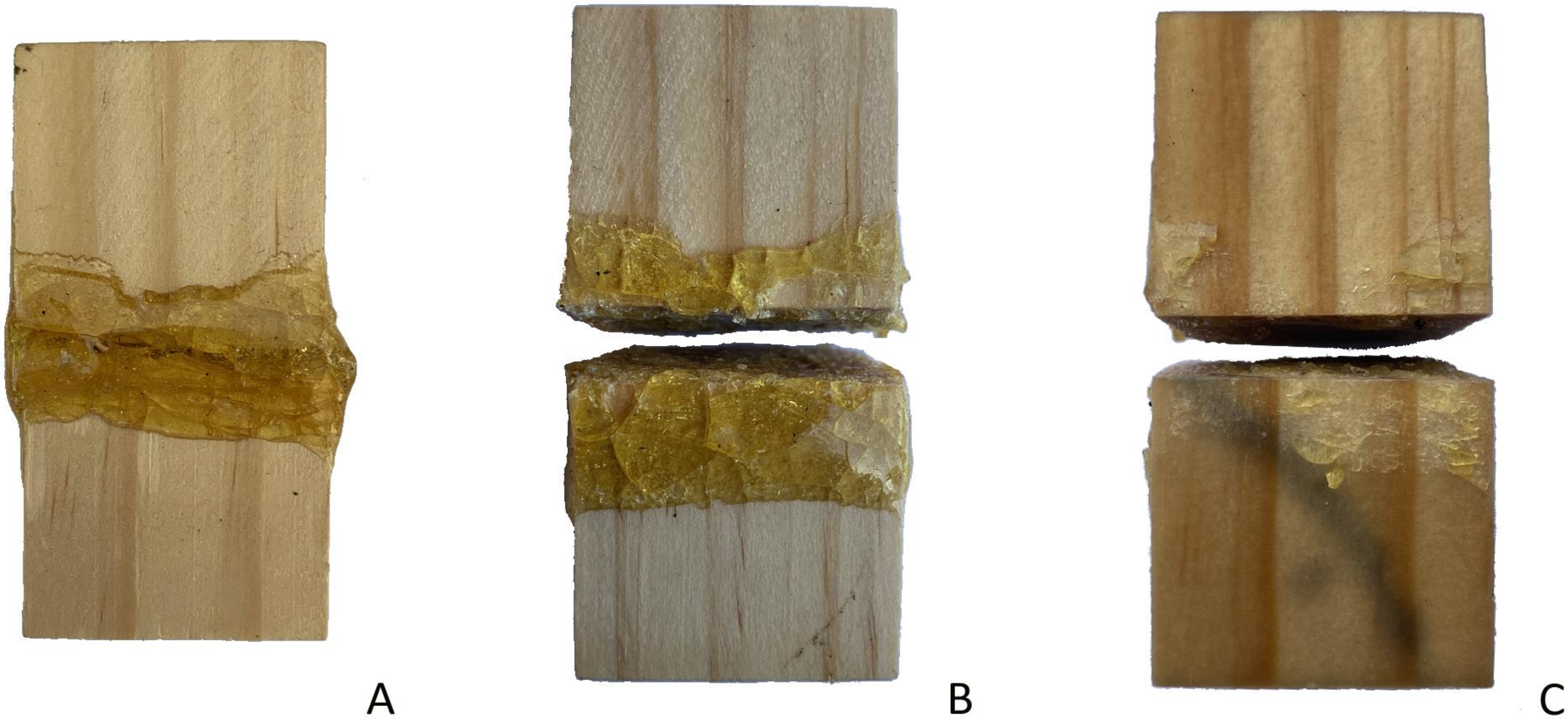


Figure 177. Plain pine resin (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

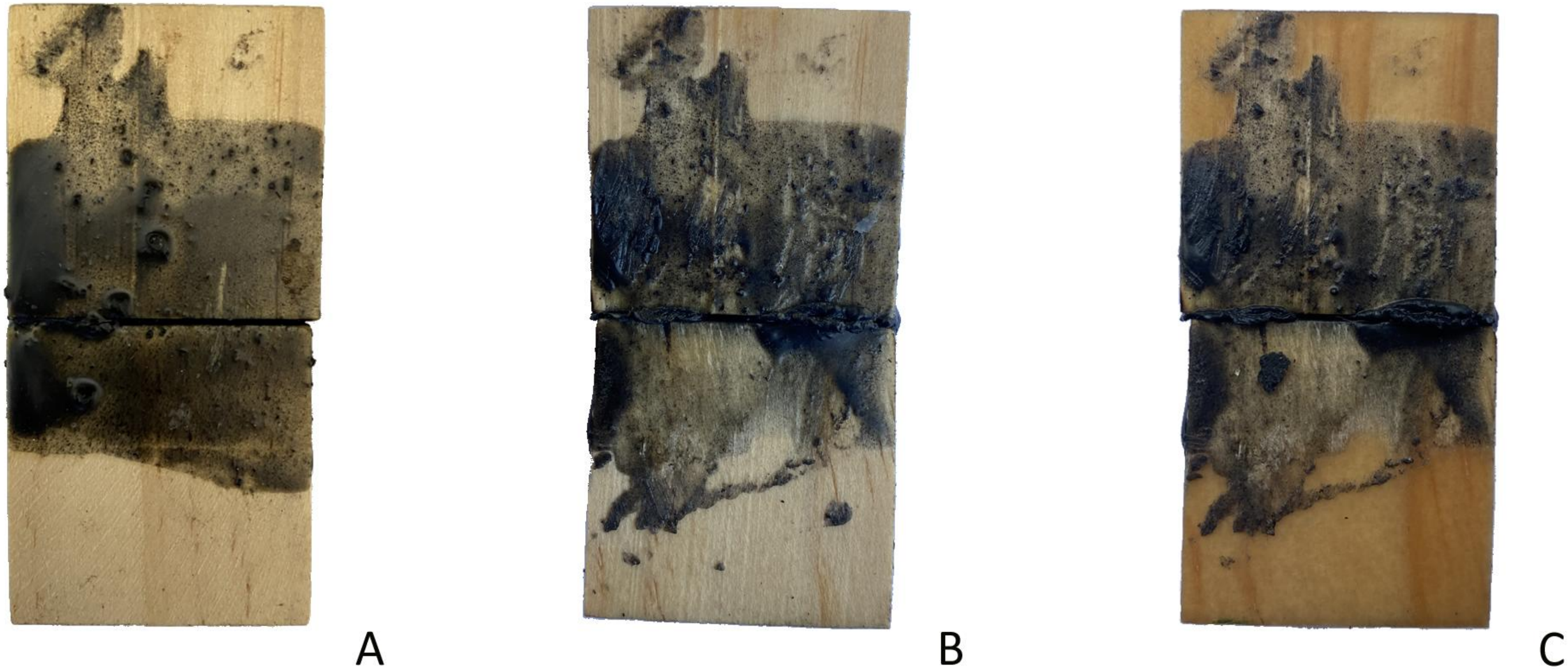


Figure 178. Compound pine resin (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

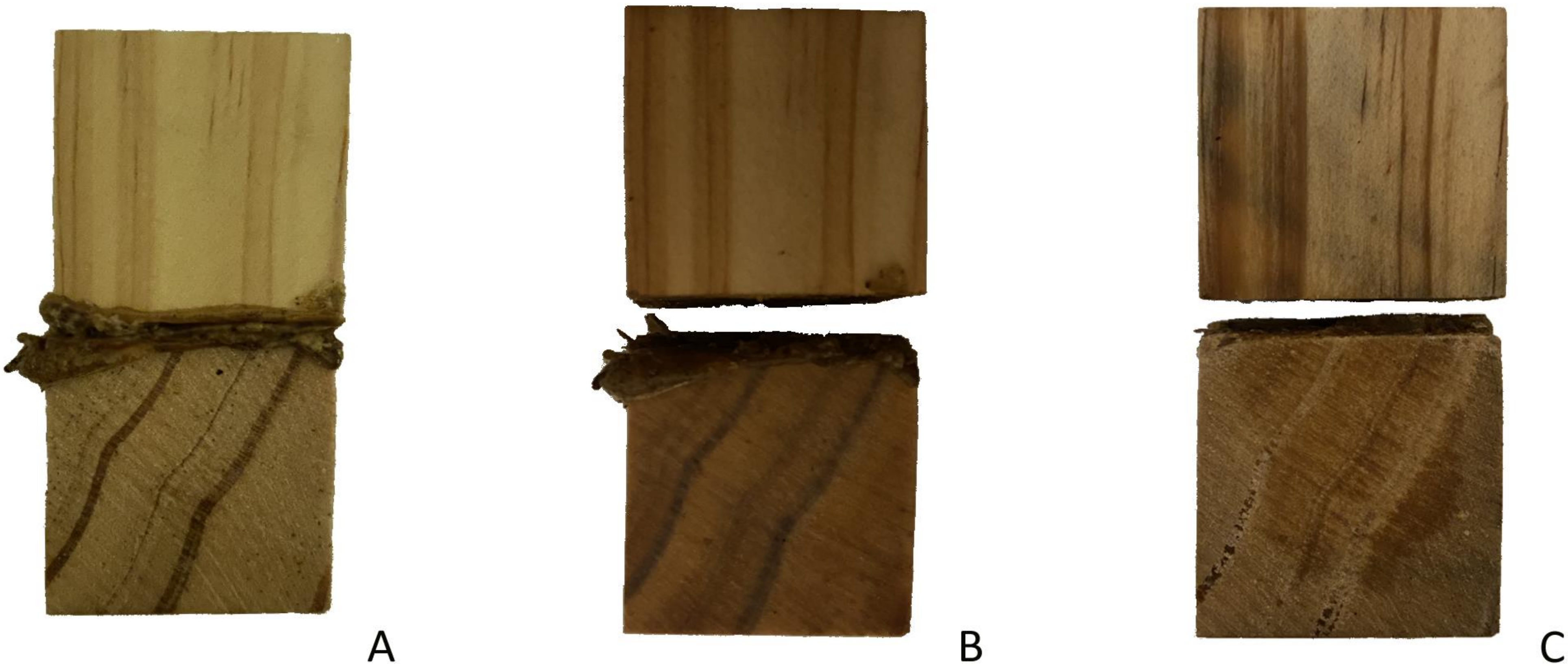


Figure 179. Plain sandarac (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

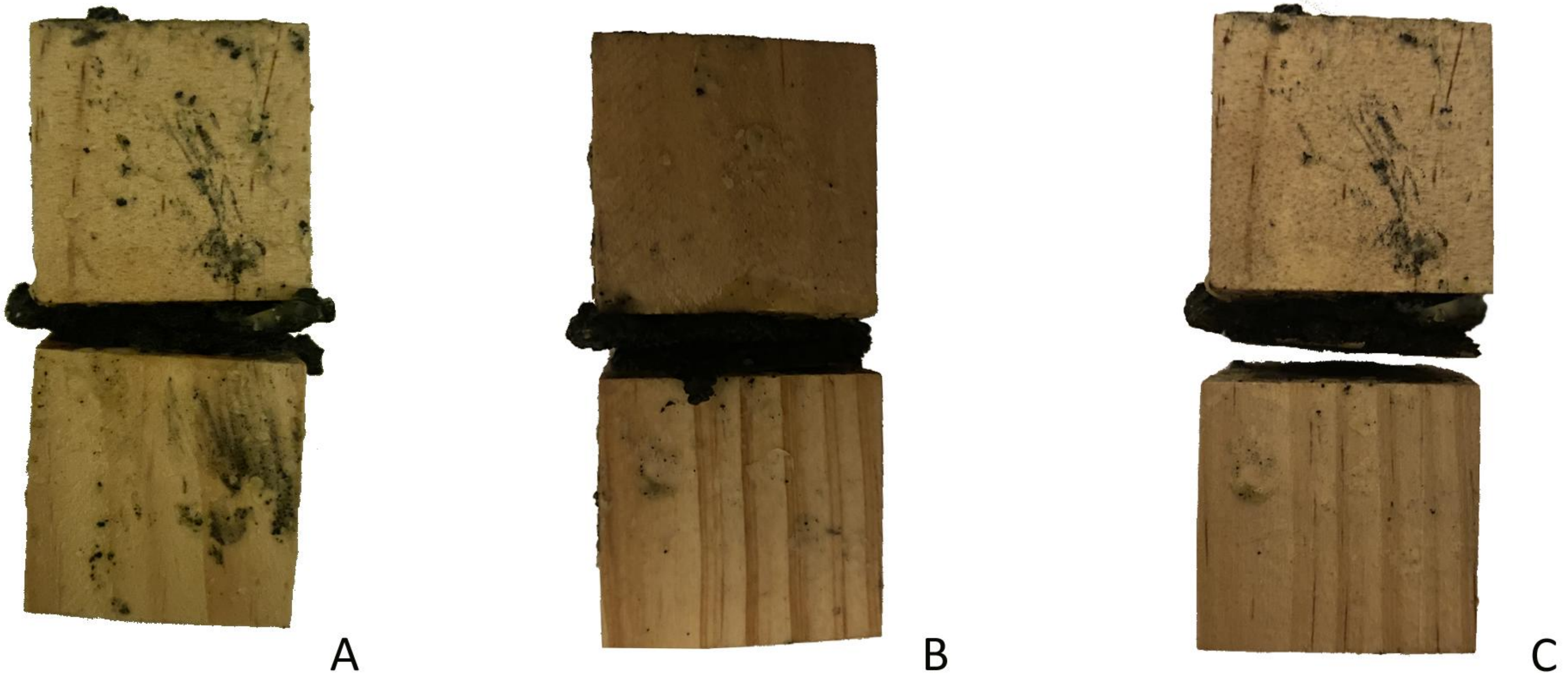


Figure 180. Compound sandarac (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

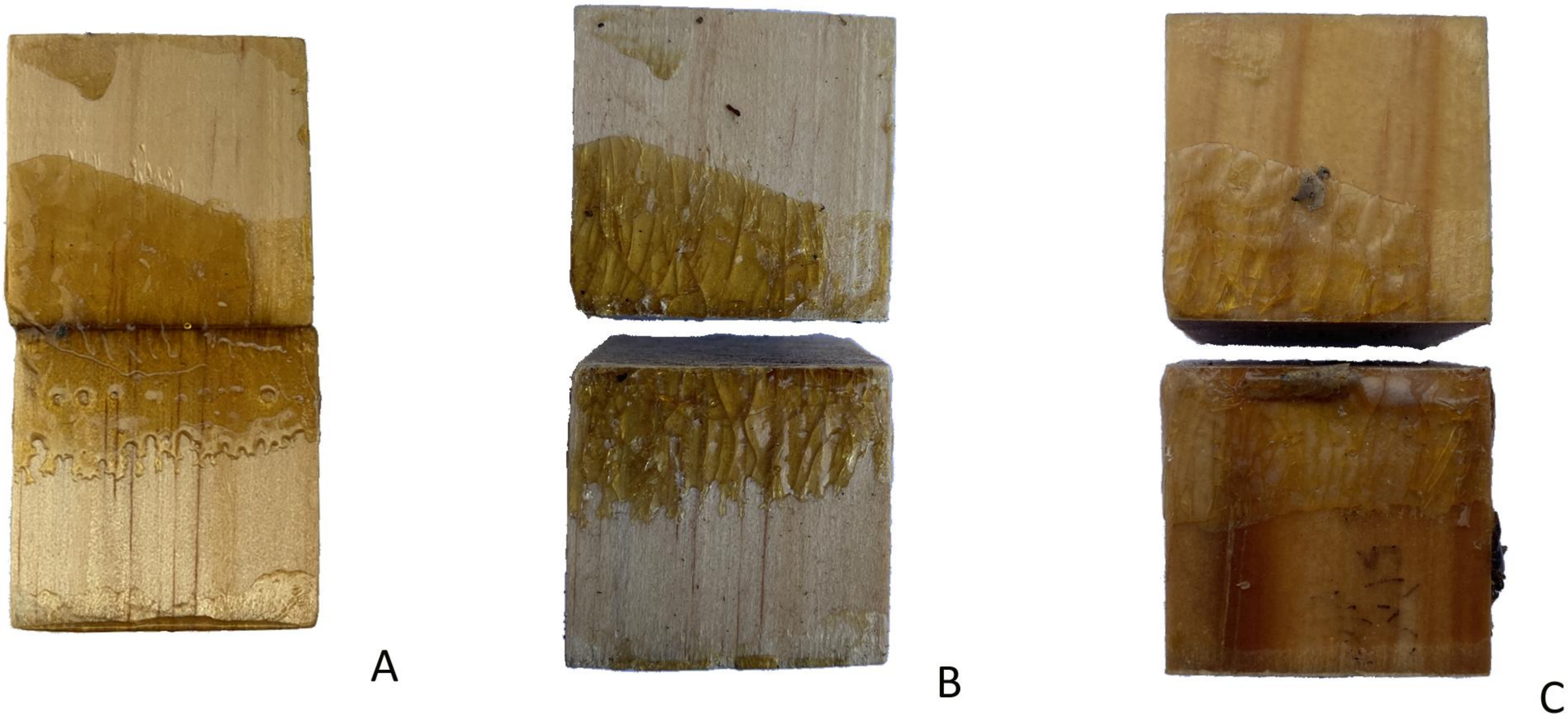


Figure 181. Plain spruce resin (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

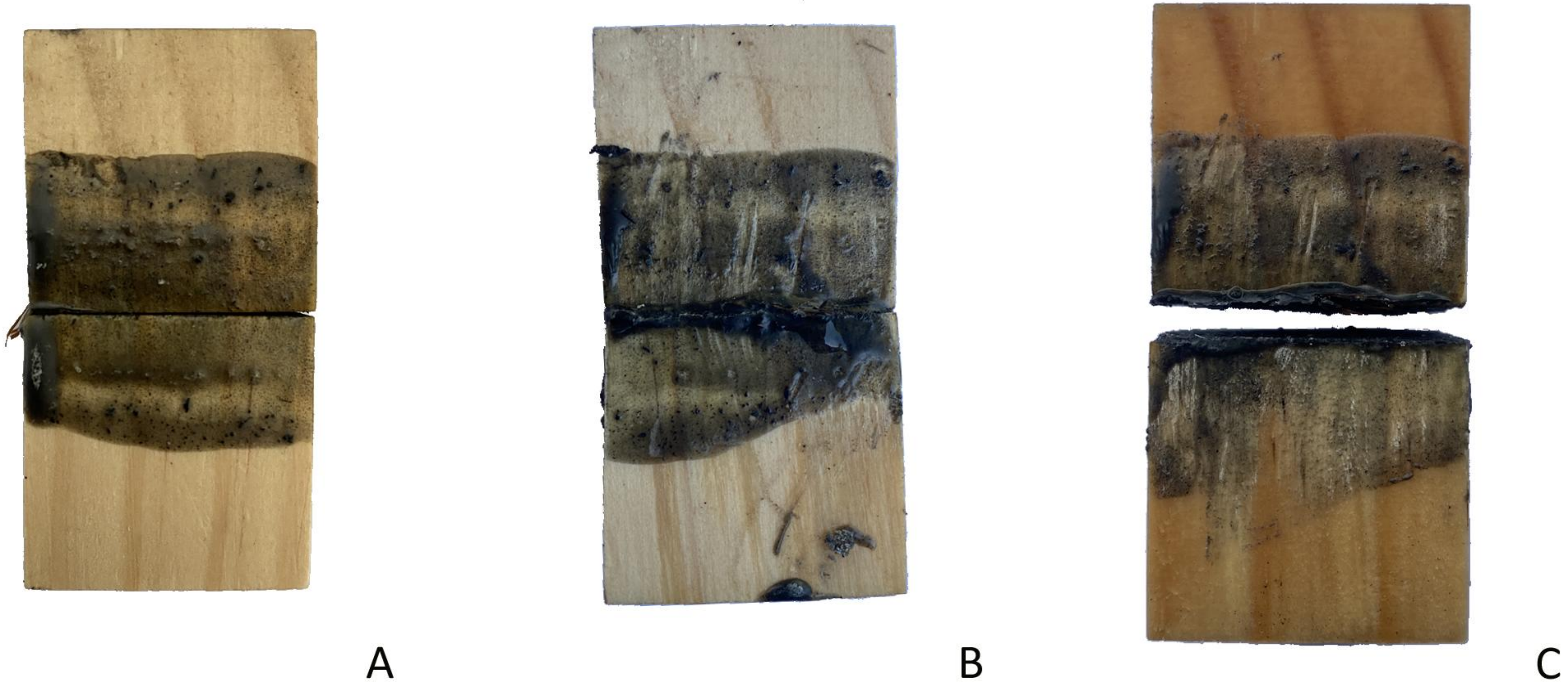


Figure 182. Compound spruce resin (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

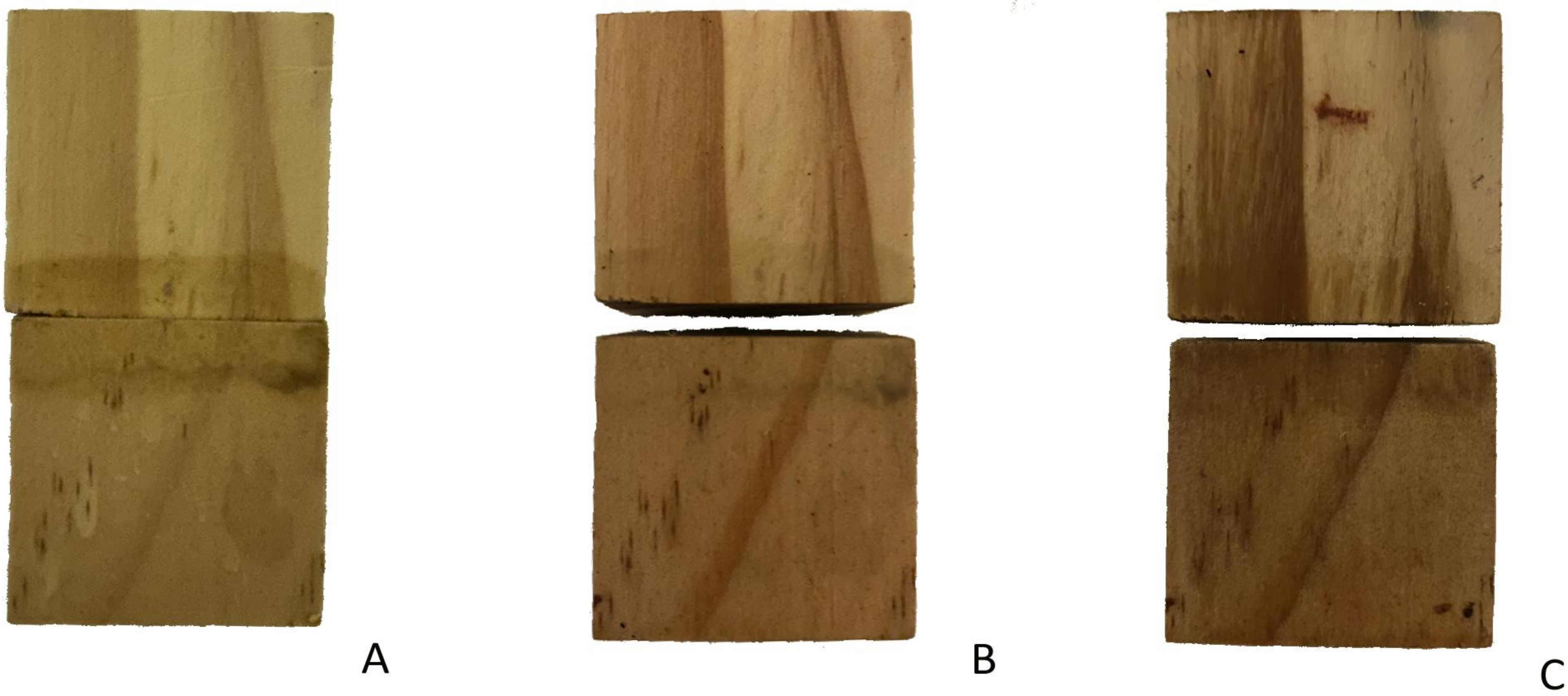


Figure 183. Plain trout bone glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

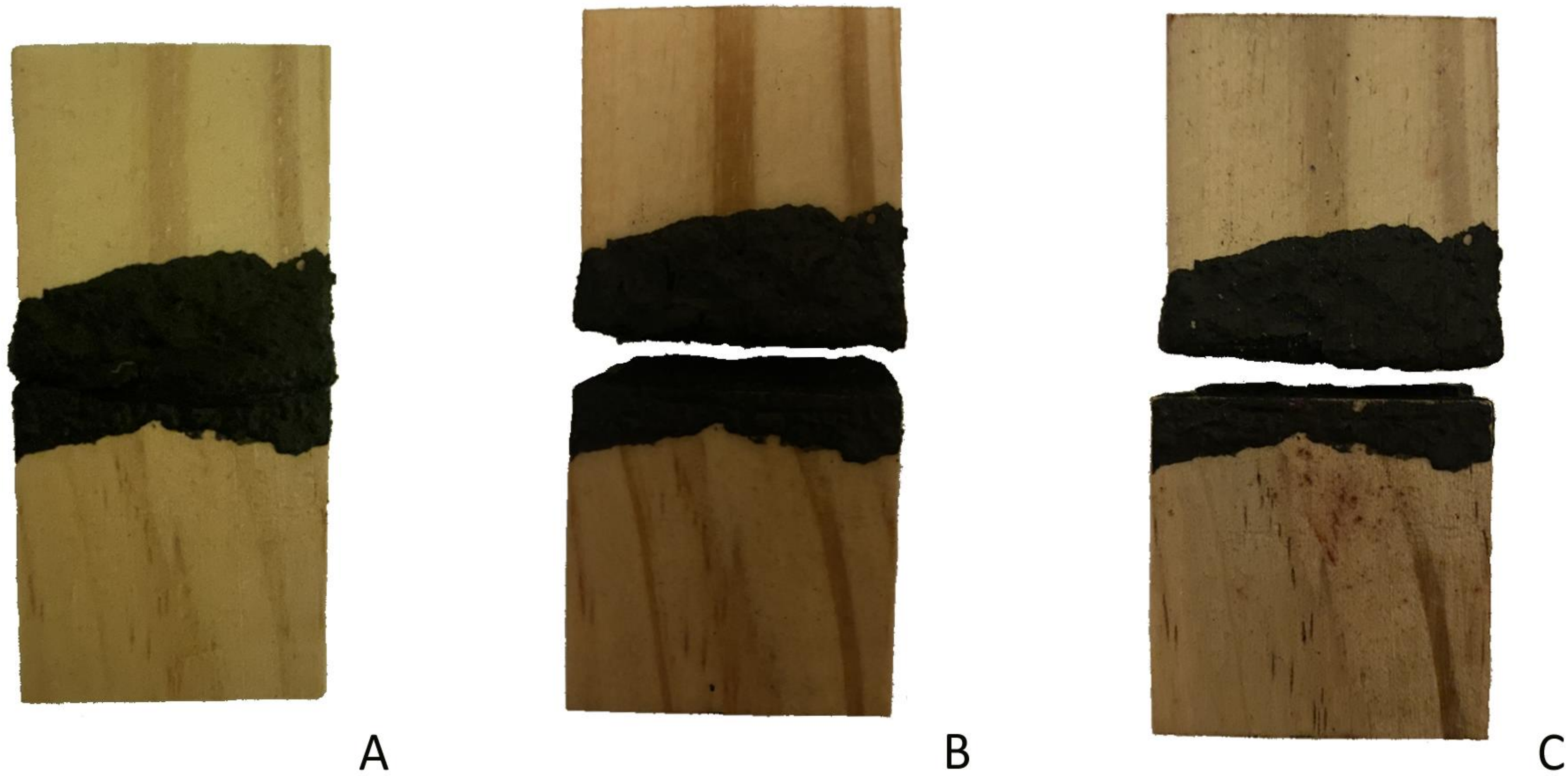


Figure 184. Compound trout bone glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

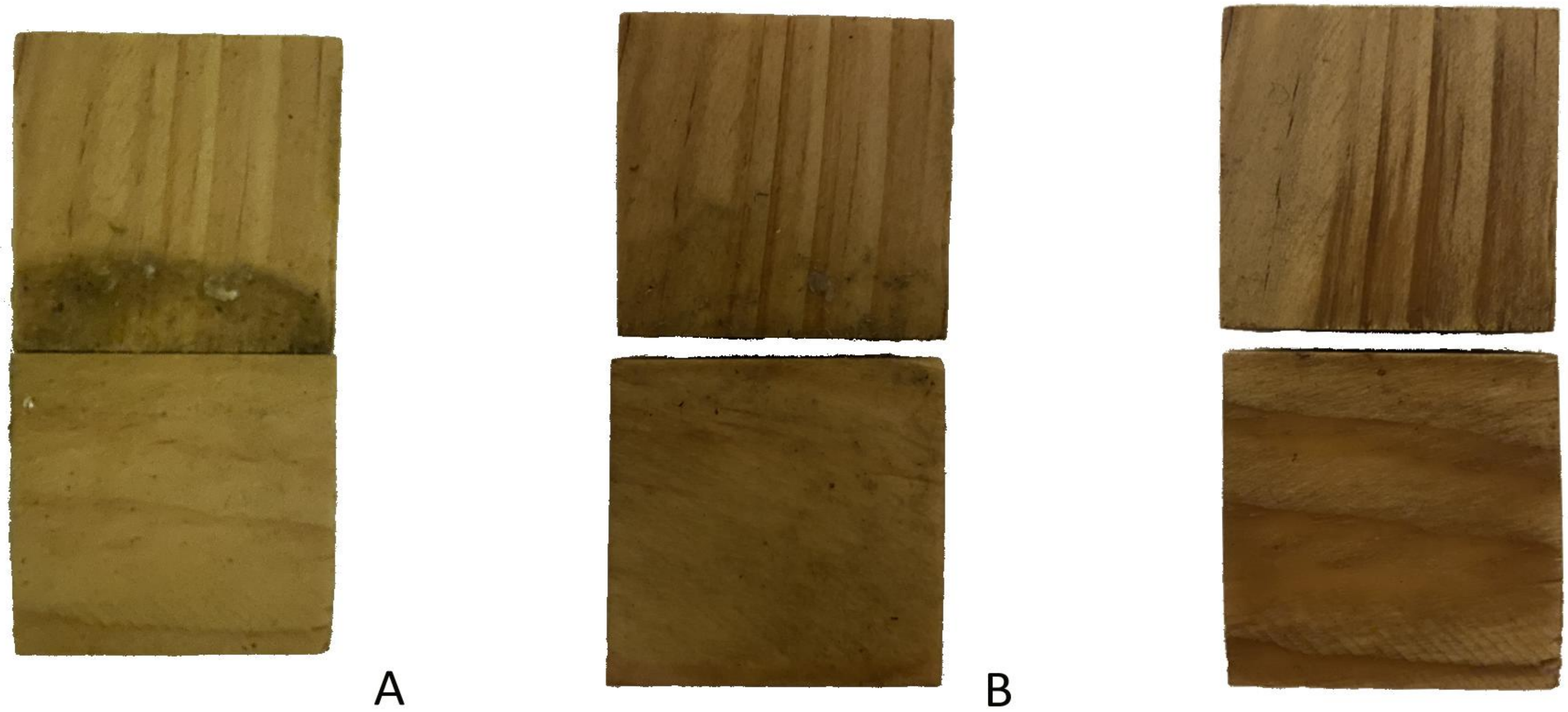


Figure 185. Plain trout skin glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

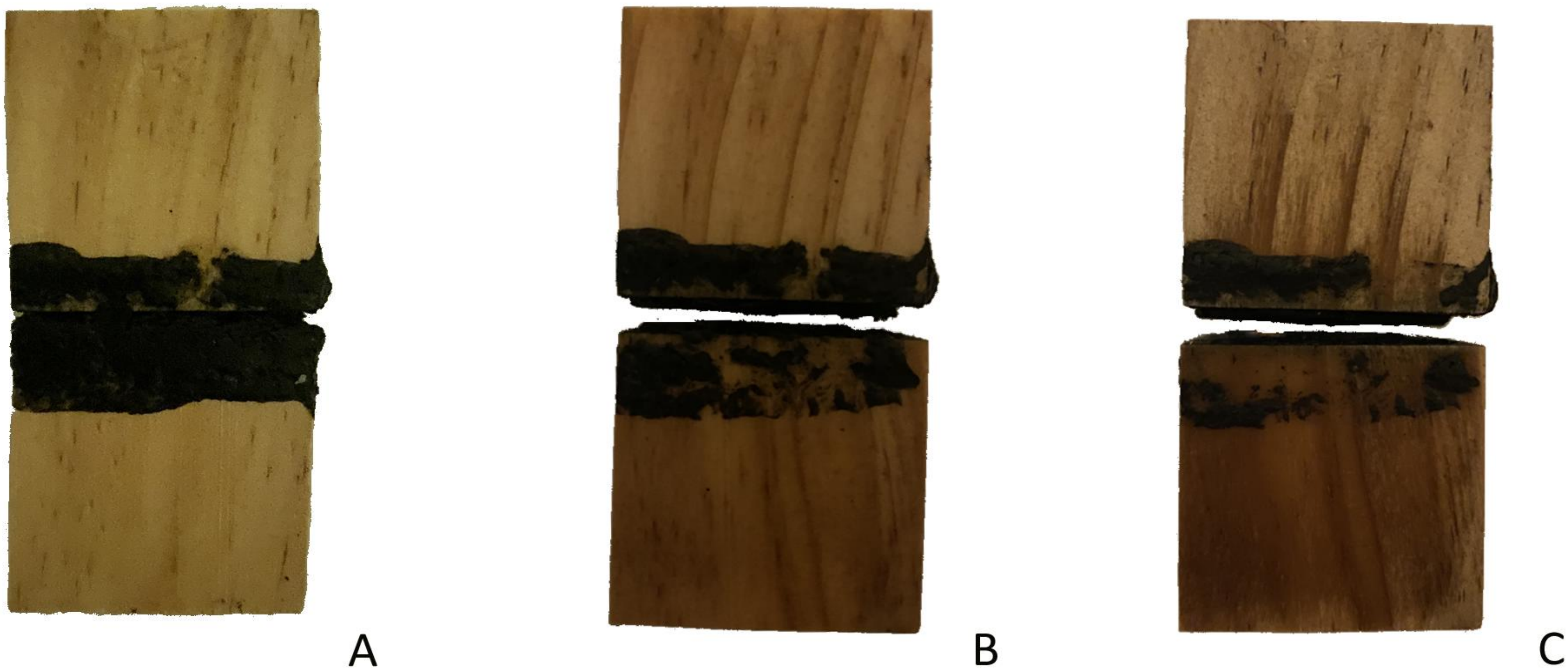


Figure 186. Compound trout skin glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

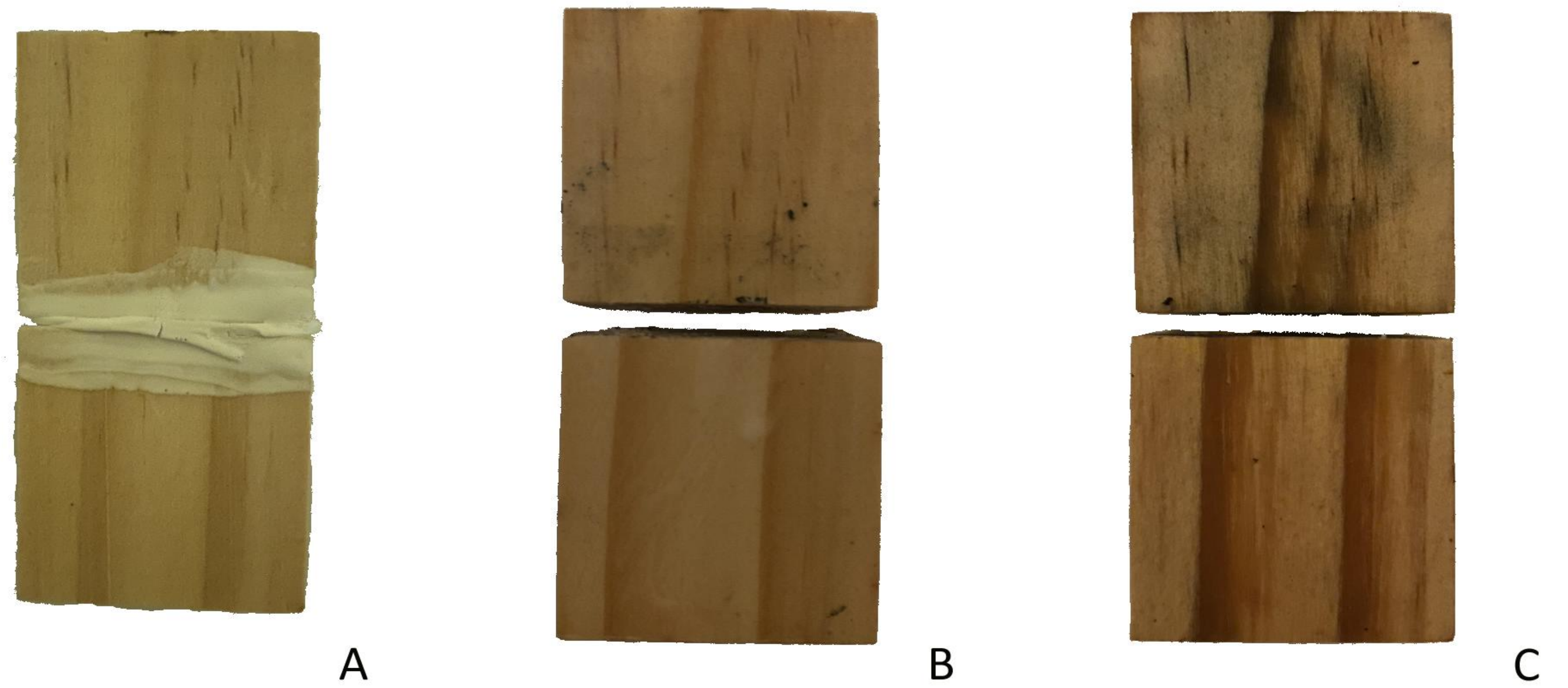


Figure 187. Plain wheat starch glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

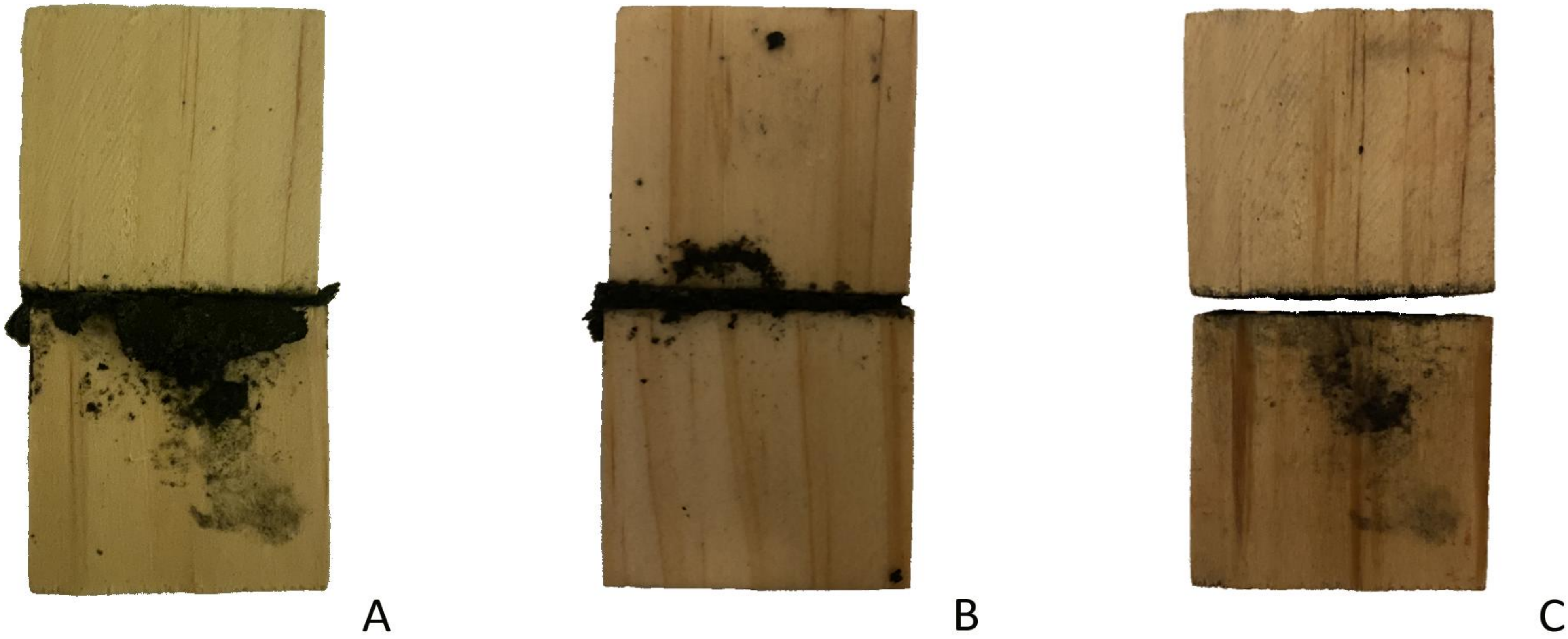


Figure 188. Compound wheat starch glue (A) before water exposure, (B) after 15 minutes and (C) after the full 24-hour period.

Bibliography

Abbès, F. (2007). Les débitages laminaires de la fin du PPNA (Jerf el Ahmar, Mureybet, Cheikh Hassan) [Laminar debitages at the end of the PPNA (Jerf el Ahmar, Mureybet, Cheikh Hassan)]. In Astruc, L., Binder, D. and Briois, F. (Eds.), *Systèmes techniques et communautés du Néolithique précéramique au Proche-Orient [Technical Systems and Near Eastern PPN Communities].* Antibes: Éditions APDCA, pp. 317-326.

Adriani, N. and Kruijt, A.C. (1951). *The Bare'e-Speaking Toradja of Central Celebes (The East Toradja): Third Volume*. Amsterdam: Noord-Hollandsche Uitgevers Maatschappij.

Akkermans, P.A., Boerma, J.A.K., Clason, A.T., Hill, S.G., Lohof, E., Meiklejohn, C., le Mière, M., Molgat, G.M.F., Roodenberg, J.J., Waterbolk-van Rooyen, W. and van Zeist, W. (1983). Bouqras Revisited: Preliminary Report on a Project in Eastern Syria. *Proceedings of the Prehistoric Society*, 49, pp. 335-372.

Akkermans, P.M.M.G. (1987). A Late Neolithic and Early Halaf village at Sabi Abyad, Northern Syria. *Paléorient*, 13 (1), pp. 23-40.

Akkermans, P.M.M.G. and Cavallo, C. (1999). When the Bullet Hits the Bone. *Neo-Lithics*, 2/99, pp. 10-11.

Akkermans, P.M.M.G. and Duistermaat, K. (1996). Of storage and nomads: The sealings from Late Neolithic Sabi Abyad, Syria. *Paléorient*, 22 (2), pp. 17-44.

al-Ameri, T.K., Jasim, S.Y. and al-Khafaji, A.J.S. (2010). Middle paleolithic to neolithic cultural history of North Iraq. *Arabian Journal of Geosciences*, 4 (5-6), pp. 945-972.

al-Nahar, M. (2006). Tell Abu as-Sawwan. *Neo-Lithics*, 1/06, pp. 7-12.

al-Nahar, M. (2014). 'Ain Ghazal and Wadi Shueib: Neolithic Personal Ornaments. In Rollefson, G.O., Finlayson, B. and Makarewicz, C. (Eds.), *Settlement, Survey, and Stone: Essays on Near Eastern Prehistory in honor of Gary Rollefson*. Berlin: Ex Oriente, pp. 243-256.

Alakbarov, V.A. (2015). Pottery production at Neolithic Göytepe (West Azerbaijan). *Hileya: Naukovyy Visnyk [Gileya: Scientific Bulletin]*, 102, pp. 166-169.

Alakbarov, V.A. (2018). Technological Development of the Neolithic Pottery at Göytepe (West Azerbaijan). *Archaeology, Ethnology & Anthropology of Eurasia*, 46 (3), pp. 22-31.

Alexandrova, O.I., Kireeva, V.N. and Leonova, E.V. (2014). Opyt issledovaniya ostatkov veshchestv organicheskoye i neorganicheskoye proiskhozhdeniye na poverkhnosti kamennykh instrumentov iz Mezoliticheskogo sloya peshchernoy Dvoynoy (Severo-Zapadnyy Kavkaz) [Study of Organic and Inorganic Residues on the Stone Tools from the Early Mesolithic Layer in the Dvoinaya Cave (Northwestern Caucasus)]. *Archaeology, Ethnology & Anthropology of Eurasia*, 4 (60), pp. 2-12.

Ambrose, S.H. (1998). Chronology of the Later Stone Age and food production in East Africa. *Journal of Archaeological Science*, 25 (4), pp. 377-392.

Amkreutz, L. and Spithoven, M. (2019). Hunting beneath the waves: Bone and antler points from North Sea Doggerland off the Dutch coast. In Groß, D., Lübke, H., Meadows, J. and Jantzen, D. (Eds.), *Working at the Sharp End: From Bone and Antler to Early Mesolithic Life in Northern Europe*. Kiel and Hamburg: Wachholtz Verlag, pp. 383-404

Ammerman, A.J., Shaffer, G.D. and Hartmann, N. (1988). A Neolithic Household at Piana di Curinga, Italy. *Journal of Field Archaeology*, 15 (2), pp. 121-140.

Anastassova, E. (2008). Stone tools from the early Neolithic site Dobroslavtsi, Sofia region. In Kostov, R.I., Gaydarska, B. and Gurova, M. (Eds.), *Geoarchaeology and Archaeomineralogy: Proceedings of the International Conference, 29-30 October 2008, Sofia*. Sofia: St. Ivan Rilski, pp. 51-54.

Anderson, E., Almond, M.J. and Matthews, W. (2014). Analysis of wall plasters and natural sediments from the Neolithic town of Çatalhöyük

(Turkey) by a range of analytical techniques. *Spectrochimica Acta Part A: Molecular and Biomolecular Spectroscopy*, 133, pp. 326-334.

Anderson, J. (1890). Report on the museums of Switzerland and North Italy, obtained under the Victoria Jubilee gift of His Excellency Dr R. H. Gunning, F.S.A. Scot. *Proceedings of the Society of Antiquaries of Scotland*, 24, pp. 478-510.

Anderson, K.J. (1990). Adhesive materials. *MRS Bulletin*, 15 (8), pp. 78-79.

Anderson, P.C. (1991). Harvesting of wild cereals during the Natufian as seen from experimental cultivation and harvest of wild einkorn wheat and microwear analysis of stone tools. In Bar-Yosef, O. and Valla, F.R. (Eds.), *The Natufian Culture in the Levant*. Ann Arbor: International Monographs in Prehistory, pp. 521-556.

Anderson, P.C. (1994). Interpreting traces of Near Eastern Neolithic craft activities: An ancestor of the threshing sledge for processing domestic crops? *Helinium*, 34 (2), pp. 306-321.

Anderson-Gerfaud, P. (1983). A consideration of the uses of certain backed and lustred stone tools from late Mesolithic and Natufian levels of Abu Hureyra and Mureybet (Syria). In Cauvin, M.C. (Ed.), *Traces d'utilisation sur les outils néolithiques du Proche Orient: Table ronde CNRS tenue à Lyon du 8 au 10 juin 1982 [Traces of use on Neolithic tools from the Near East: CNRS round table held in Lyon from June 8 to 10, 1982*. Lyon: Maison de 'Orient et de la Méditerranée Jean Pouilloux, pp. 77-105.

Arie, E., Rosen, B. and Namdar, D. (2020). Cannabis and frankincense at the Judahite Shrine of Arad. *Tel Aviv*, 47 (1), pp. 5-28.

Arkun, B.H. (2003). *Neolithic Plasters of the Near East: Catal Hoyuk Building, a Case Study*. Unpublished: University of Pennsylvania. MA.

Asryan, L. and Ollé, A. (2020). Results of a functional study on the Middle to early Upper Pleistocene lithic assemblages from the Azokh 1 Cave site (South Caucasus). *Quaternary International*, 569, pp. 168-180.

Audouin, F. and Plisson, H. (1982). Les ocres et leurs témoins au Paléolithique en France: enquête et expériences sur leur validité archéologique [Ochres and their traces in the Palaeolithic of France: investigation and experiments on their archaeological validity]. *Cahiers due Centre de Recherches Préhistoriques*, 8, pp. 33-80.

Aveling, E.M. and Heron, C. (1998a). Identification of Birch Bark Tar at the Mesolithic Site of Star Carr. *Ancient Biomolecules*, 2, pp. 69-80.

Aveling, E.M. and Heron, C. (1998b). Neolithic glue from the Sweet Track, Somerset. *England News WARP*, 23, pp. 5-8.

Aveling, E.M. and Heron, C. (1999). Chewing tar in the early Holocene: an archaeological and ethnographic evaluation. *Antiquity*, 73 (281), pp. 579-584.

Baales, M., Birker, S. and Mucha, F. (2017). Hafting with beeswax in the Final Palaeolithic: a barbed point from Bergkamen. *Antiquity*, 91 (359), pp. 1155-1170.

Bacvarov, K. and Gorczyk, J. (2018). Of pits and bones: A ritual pit at the late Neolithic site of Sarnevo in Bulgarian Thrace. In Ivanova, M., Athanassou, B., Petrova, V., Takorova, D. and Stockhammer, P.W. (Eds.), *Social Dimensions of Food in the Prehistoric Balkans*. Oxford: Oxbow Books, pp. 141-156.

Bader, G.D., Cable, C., Lentfer, C. and Conard, N.J. (2016). Umbeli Belli Rock Shelter, a forgotten piece from the puzzle of the Middle Stone Age in KwaZulu-Natal, South Africa. *Journal of Archaeological Science: Reports*, 9, pp. 608-622.

Bader, N.O. (1993). Tell Maghzaliyah: an early Neolithic site in northern Iraq. In Yoffee, N. and Clark, J.J. (Eds.), *Early Stages in the Evolution of Mesopotamian Civilization: Soviet Excavations in Northern Iraq*. Tucson: University of Arizona Press, pp. 7-40.

Balbo, A.L., Iriarte, E., Arranz, A., Zapata, L., Lancelotti, C., Madella, M., Teira, L., Jiménez, M., Braemer, F. and Ibáñez, J.J. (2012). Squaring the Circle. Social and Environmental Implications of Pre-Pottery Neolithic

Building Technology at Tell Qarassa (South Syria). *PLoS ONE*, 7 (7), e42109. DOI: https://doi.org/10.1371/journal.pone.0042109.

Ballin-Smith, B. (2011). The daub and other clay materials. [Online]. *Scottish Archaeological Internet Reports*, 49, 25. Available at http://soas.is.ed.ac.uk/index.php/sair/article/view/3079. [Accessed 10/09/2021].

Bánffy, E. and Höhler-Brockmann, H. (2020). Burnt daub talking: The formation of the LBK longhouse (a work hypothesis). *Quaternary International*, 560-561, pp. 179-196.

Bánffy, E., Jakucs, J., Köhler, K., Marton, T., Oross, K. and Osztás, A. (2017). Buried in mud, buried in clay: specially arranged settlement burials from in and around the Danubian Sárköz, Neolithic southern Hungary. In Bickle, P., Cummings, V., Hofmann, D. and Pollard, J. (Eds.), *The Neolithic of Europe: Papers in Honour of Alasdair Whittle*. Oxford: Oxbow Books, pp. 47-62.

Bánffy, E., Marton, T. and Osztás, A. (2010). Early Neolithic settlement and burials at Alsónyék-Bátaszék. In Kozłowski, J.K. and Raczky, P. (Eds.), *Neolithization of the Carpathian Basin: Northernmost Distribution of the Starčevo/Körös Culture: Papers presented on the Symposium Organized by the EU Project Fepre (The Formation of Europe: Prehistoric Population Dynamics and the roots of Socio-Cultural Diversity)*. Kraków / Budapest: Polish Academy of Arts and Sciences Kraków / Institute of Archaeological Sciences of the Eötvös Loránd University Budapest, pp. 37-51.

Banning, E.B. and Byrd, B.F. (1984). The Architecture of PPNB ‘Ain Ghazal, Jordan. *Bulletin of the American Schools of Oriental Research*, 255, pp. 15-20.

Banning, E.B. and Najjar, M. (1999). Excavations at Tell Rakan, a Neolithic Site in Wadi Ziqlab, Jordan. *Neo-Lithics*, 2/99, pp. 1-3.

Barclay, G.J., Brophy, K. and MacGregor, G. (2002). A Neolithic building at Claish Farm, near Callander, Stirling Council, Scotland, UK. *Antiquity*, 76, pp. 23-24.

Barry, R.G. and Hall-McKim, E.A. (2014). *Essentials of the Earth's Climate System*. Cambridge: Cambridge University Press.

Bartík, J., Škrdla, P., Šebela, L., Přichystal, A. and Nejman, L. (2019). Mining and processing of the Stránská skála-type chert during the Late Neolithic and Early Eneolithic periods. *Archeologické Rozhledy*, 71 (3), pp. 373-417.

Bartl, K., Hijazi, M. and Haidar, A. (2006). The Late Neolithic Site of Shir: Preliminary Report of the German-Syrian Cooperation Project 2006. *Neo-Lithics*, 2/06, pp. 15-18.

Barton, H., Piper, P.J., Rabett, R. and Reeds, I. (2009). Composite hunting technologies from the Terminal Pleistocene and Early Holocene, Niah Cave, Borneo. *Journal of Archaeological Science*, 36 (8), pp. 1708-1714.

Bar-Yosef, O. (1980). A human figurine from a Khiamian site in the Lower Jordan Valley. *Paléorient*, 6, pp. 193-199.

Bar-Yosef, O. (1983). The Natufian in the Southern Levant. In Smith, P.E.L. and Mortensen, P. (Eds.), *The Hilly Flanks and Beyond*. Chicago: University of Chicago Oriental Institute, pp. 11-42.

Bar-Yosef, O. (1987). Direct and indirect evidence for hafting in the Epi-Palaeolithic and Neolithic of the Southern Levant. In Bar-Yosef, O. and Stordeur, D. (Eds.), *La Main et l'Outil: Manches et emmanchements préhistoriques: Table Ronde C.N.R.S. tenue à Lyon du 26 au 29 novembre 1984 [The Hand and the Tool: prehistoric handles and fittings: C.N.R.S round table held in Lyon from November 26 to 29, 1984]*. Lyon: Maison de l'Orient et de la Méditerranée Jean Pouilloux, pp. 155-164.

Bar-Yosef, O. (1991). The Archaeology of the Natufian Layer at Hayonim Cave. In Bar-Yosef, O. and Valla, F.R. (Eds.), *The Natufian Culture in the Levant*. Ann Arbor: International Monographs in Prehistory, pp. 81-90.

Bar-Yosef, O. (2002). The Upper Paleolithic Revolution. *Annual Review of Anthropology*, 31, pp. 363-393.

Bar-Yosef, O. (2007). The Archaeological Framework of the Upper Paleolithic Revolution. *Diogenes*, 214, pp. 3-18.

Bar-Yosef, O. and Alon, D. (1988). Nahal Hemar Cave: The Excavations. *'Atiqot*, 18, pp. 1-30.

Bar-Yosef, O. and Belfer-Cohen, A. (2000). Nahal Ein Gev II – A Late Epi-Paleolithic Site in the Jordan Valley. *Mitekufat Haeven: Journal of the Israel Prehistoric Society*, 30, pp. 49-71.

Bar-Yosef, O. and Goring-Morris, A.N. (1977). Geometric Kebaran A occurences. In Bar-Yosef, O. and Phillips, J.L. (Eds.), *Prehistoric Investigations in Gebel Maghara, Northern Sinai*. Jerusalem: Hebrew University, pp. 115-148.

Bar-Yosef, O., Gopher, A., Goring-Morris, N. and Kozlowski, S.K. (2010). The Stratigraphy and Architecture of Gilgal I. In Bar-Yosef, O., Goring-Morris, N. and Gopher, A. (Eds.), *Gilgal: Early Neolithic Occupations in the Lower Jordan Valley: The Excavations of Tamar Noy*. Oxford and Oakville: Oxbow Books, pp. 11-26.

Bar-Yosef, O., Gopher, A., Tchernov, E. and Kislev, M.E. (1991). Netiv Hagdud: An Early Neolithic Village Site in the Jordan Valley. *Journal of Field Archaeology*, 18 (4), pp. 405-424.

Beaurepaire, A., Piot, N., Doublet, V., Antunez, K., Campbell, E., Chantawannakul, P., Chejanovsky, N., Gajda, A., Heerman, M., Panziera, D., Smagghe, G., Yañez, O., de Miranda, J.R. and Dalmon, A. (2020). Diversity and Global Distribution of Viruses of the Western Honey Bee, Apis mellifera. *Insects*, 11, 239. DOI: https://doi.org/10.3390/insects11040239.

Beck, C.W. (1996). Comments on a supposed Clovis "mastic". Journal of Archaeological Science, 23, pp. 459-460.

Beech, M., Cuttler, R., Moscrop, D. Kallweit, H. and Martin, J. (2005). New evidence for the Neolithic settlement of Marawah Island, Abu Dhabi, United Arab Emirates. *Proceedings of the Seminar for Arabian Studies*, 35, pp. 37-56.

Beech, J.M., Cuttler, R.T.H., Al Kaabi, A.K., El Faki, A.A., Martin, J., Al Hameli, N.H., Roberts, H.M., Spencer, P., Tomasi, D., Brunet, O. and

Crassard, R. (2020). Excavations at MR11 on Marawah Island (Abu Dhabi, UAE): new insight into the architecture and planning of Arabian Neolithic settlements and early evidence for pearling. *Arabian Archaeology and Epigraphy*, 31, pp. 19-31.

Bellwood, P. (2005). F*irst Farmers: The Origins of Agricultural Societies*. Malden: Blackwell Publishing.

Beneš, J., Naumov, G., Majerovičová, T., Budilová, K., Živaljević, I., Dimitrijević, V., Bumerl, J., Komárková, V., Kovárník, J., Vychronová, M. and Stefanović, S. (2018). Onsite Bioarchaeological Knowledge of the Neolithic settlements in the Balkans: The case of Vrbjanska Čuka, a tell-site in Pelagonia, Republic of Macedonia. In Florenzano, A., Montecchi, M.C. and Rinaldi, R. (Eds.), *Humans and environmental sustainability: Lessons from the past ecosystems of Europe and Northern Africa*. Modena / Reggio Emilia: Università degli Studi di Modena e Reggio Emilia, pp. 91-94.

Beneš, J., Vondrovský, V., Kovačiková, L., Šída, P. and Divišová, M. (2014). Decoding the Neolithic Building Complex: the Case of the Extraordinarily Large House III from Hrdlovka, Czech Republic. *Interdisciplinaria Archaeologica: Natural Sciences in Archaeology*, 5, p. 99-118.

Berclay, G.J., Carter, S.P., Dalland, M.M., Hastie, M., Holden, T.G., MacSween, A. and Wickham-Jones, C.R. (2001). A possible Neolithic settlement at Kinbeachie, Black Isle, Highland. *Proceedings of the Society of Antiquaries of Scotland*, 131, pp. 57-85.

Bernal, J.L., Jiménez, J.J., del Nozal, M.J., Toribio, L. and Martín, M.T. (2005). Physico-chemical parameters for the characterization of pure beeswax and detection of adulterations. *European Journal of Lipid Science and Technology*, 107 (3), pp. 158-166.

Bernardini, F., Sibilia, E., Kasztovszky, Zs., Boscutti, F., De Min, A., Lenaz, D., Turco, G., Micheli, R., Tuniz, C. and Montagnari Kokelj, M. (2017). Evidence of open-air late prehistoric occupation in the Trieste area (north-eastern Italy): dating, 3D clay plaster characterization and obsidian provenancing. *Archaeological and Anthropological Sciences*, 10 (8), pp. 1933-1943.

Bernardini, F., Tuniz, C., Coppa, A., Mancini, L., Dreossi, D., Eichert, D., Turco, G., Biasotto, M., Terrasi, F., De Cesare, N., Hua, Q. and Levchenko, V. (2012). Beeswax as Dental Filling on a Neolithic Human Tooth. *PLoS ONE*, 7 (9), e44904. DOI: https://doi.org/10.1371/journal.pone.0044904.

Best, E. (1924). *The Maori: Volume 2*. Wellington: H.H. Tombs.

Binder, D., Bourgeois, G., Benoist, F., and Vitry, C. (1990). Identification de brai de bouleau (Betula) dans le Néolithique de Giribaldi (Nice, France) par la spectrométrie de masse. *Revue d'Archéométrie*, 14 (1), pp. 37-42.

Bleicher, B., Kelstrup, C., Olsen, J.V. and Cappellini, E. (2015). Molecular evidence of use of hide glue in 4th millennium BC Europe. *Journal of Archaeological Science*, 63, pp. 65-71.

Bocquentin, F. and Garrard, A. (2016). Natufian collective burial practice and cranial pigmentation: A reconstruction from Azraq 18 (Jordan). *Journal of Archaeological Science: Reports*, 10, pp. 693-702.

Bocquentin, F., Khalaily, H., Bar-Yosef Mayer, D.E., Berna, F., Biton, R., Boness, D., Dubreuil, L., Emery-Barbier, A., Greenberg, H., Goren, Y., Horwitz, L.K., Le Dosseur, G., Lernau, O., Mienis, H.K., Valentin, B. and Samuelian, N. (2014). Renewed Excavations at Beisamoun: Investigating the 7th Millennium cal. BC of the Southern Levant. *Mitekufat Haeven: Journal of the Israel Prehistoric Society*, 44, pp. 5-100.

Bocquet-Appel, J.-P. and Bar-Yosef, O. (2008). *The Neolithic Demographic Transition and its Consequences*. Berlin: Springer Science+Business Media.

Boëda, E., Bonilauri, S., Connan, J., Jarvie, D., Mercier, N., Tobey, M., Valladas, H. and al Sakhel, H. (2008). New Evidence for Significant Use of Bitumen in Middle Palaeolithic Technical Systems at Umm el Tlel (Syria) around 70,000 BP. *Paléorient*, 34 (2), pp. 67-83.

Boëda, E., Connan, J. and Muhesen, S. (1998). Bitumen as hafting material on Middle Paleolithic artifacts from the El Kowm basin, Syria. In Akazawa, T., Aoki, K. and Bar-Yosef, O. (Eds.), *Neanderthals and Modern Humans in Western Asia*. New York: Plenum Press, pp. 181-204.

Boëda, E., Connan, J., Dessort, D., Muhesen, S., Mercier, N., Valladas, H. and Tisnérat, N. (1996). Bitumen as a hafting material on Middle Palaeolithic artefacts. *Nature*, 380, pp. 336-338.

Boethius, A., Kjällquist, M., Magnell, O. and Apel, J. (2020). Human encroachment, climate change and the loss of our archaeological organic cultural heritage: Accelerated bone deterioration at Ageröd, a revisited Scandinavian Mesolithic key-site in despair. *PLoS ONE*, 15 (7), e0236105. DOI: https://doi.org/10.1371/journal.pone.0236105.

Boivin, N. and Fuller, D.Q. (2009). Shell Middens, Ships and Seeds: Exploring Coastal Subsistence, Maritime Trade and the Dispersal of Domesticates in and Around the Ancient Arabian Peninsula. *Journal of World Prehistory*, 22, pp. 133-180.

Bokelmann, K. (2012). Spade paddling on a Mesolithic lake - Remarks on Preboreal and Boreal sites from Duvensee (Northern Germany). In Stapert, D. (Ed.), *A Mind Set on Flint: Studies in Honour of Dick Stapert*. Eelde: Barkhuis, pp. 369-380.

Bondár, M. (1995). The settlement of the Lengyel culture at Zalaszentbalázs. *Antaeus*, 22, pp. 51-70.

Bondetti, M., González Carretero, L., Dolbunova, E., McGrath, K., Presslee, S., Lucquin, A., Tsybriy, V., Mazurkevich, A., Tsybriy, A., Jordan, P., Heron, C., Meadows, J. and Craig, O.E. (2021). Neolithic farmers or Neolithic foragers? Organic residue analysis of early pottery from Rakushechny Yar on the Lower Don (Russia). *Archaeological and Anthropological Sciences*, 13, 141.

Bondetti, M., Scott, S., Lucquin, A., Meadows, J., Lozovskaya, O., Dolbunova, E., Jordan, P. and Craig, O.E. (2020). Fruits, fish and the introduction of pottery in the Eastern European plain: Lipid residue analysis of ceramic vessels from Zamostje 2. *Quaternary International*, 541, pp. 104-114.

Bongers, F., Groenendijk, P., Bekele, T., Birhane, E., Damtew, A., Decuyper, M., Eshete, A., Gezaghne, A., Girma, A., Khamis, M.A., Lemenih, M., Mengistu, T., Ogbazghi, W., Sass-Klaassen, Y., Tadesse, W., Teshome, M., Tolera, M., Sterck, F. and Zuidema, P.A. (2019). Frankincense in peril. *Nature: Sustainability*, 2, pp. 602-610.

Bonogofsky, M. (2001). Cranial Modeling and Neolithic Bone Modification at 'Ain Ghazal: New Interpretations. *Paléorient*, 27 (2), pp. 141-146.

Bontemps, C., Pétrequin, P. and Pétrequin, A.-M. (2015). Les objets en bois [Wooden objects]. In Pétrequin, P. and Pétrequin, A.-M. (Eds.), *Clairvaux et le Néolithique Moyen Bourguignon. Tome 1 [Clairvaux and the Middle Burgundy Neolithic, Volume 1]*. Besançon: Presses universitaries de Franche-Comté / CRAVA, pp. 747-770.

Boroneanţ, A. (2012). The archaeological excavations at Grumăzești – Neamț County. Part 1 – refitting the puzzle. *Studii de Preistorie*, 9, pp. 25-47.

Borrell, F. and Molist, M. (2007). Projectile Points, Sickle Blades and Glossed Points: Tools and Hafting Systems at Tell Halula (Syria) during the 8th millennium cal. BC. *Paléorient*, 33 (2), pp. 59-77.

Borrell, F. and Stefanisko, D. (2016). Reconstructing projectile technology during the Pre-Pottery Neolithic B in the Levant: An integrated approach to large tanged points from Halula. *Journal of Archaeological Science*, 69, pp. 130-142.

Borrell, F., Ibáñez, J.J. and Bar-Yosef, O. (2020). Cult paraphernalia or everyday items? Assessing the status and use of the flint artefacts from Nahal Hemar Cave (Middle PPNB, Judean Desert). *Quaternary International*, 569-570, pp. 150-167.

Bosquet, D., Regert, M., Dubois, N. and Jadin, I. (2001). Identification de brai de bouleau sur quatre vases du site rubané de Fexhe-le-Haut-Clocher «Podrî l’Cortri». Premiers résultats [Identification of birch pitch on four vases from the banded site of Fexhe-Le-Haut-Clocher “Podrî l’Cortri”]. *Notæ Præhistoricae*, 21, pp. 119-127.

Boyle, K., Gamble, C. and Bar-Yosef, O. (2010). *The Upper Palaeolithic Revolution in Global Perspective: Papers in Honour of Sir Paul Mellars*. Cambridge: McDonald Institute for Archaeological Research.

Bradtmöller, M., Sarmiento, A., Perales, U. and Zuluaga, M.C. (2016). Investigation of Upper Palaeolithic adhesive residues from Cueva Morín, Northern Spain. *Journal of Archaeological Science: Reports*, 7, pp. 1-13.

Braidwood, R.J. (1954). From Cave to Village in Iraq. *Agricultural History*, 28 (2), pp. 41-43.

Brumm, A. and Moore, M.W. (2005). Symbolic Revolutions and the Australian Archaeological Record. *Cambridge Archaeological Journal*, 15 (2), pp. 157-175.

Brychova, V., Roffet-Salque, M., Pavlu, I., Kyselka, J., Kyjakova, P., Filip, V., Ivo, S. and Evershed, R.P. (2021). Animal exploitation and pottery use during the early LBK phases of the Neolithic site of Bylany (Czech Republic) tracked through lipid residue analysis. *Quaternary International*, 574, pp. 91-101.

Budja, M. (2014). Neolithic pottery and the biomolecular archaeology of lipids. *Documenta Praehistorica*, 41, pp. 196-224.

Budja, M., Ogrinc, N., Gašparič, A.Ž., Potočnik, D., Žigon, D. and Mlekuž, D. (2013). Transition to farming – transition to milk culture: a case study from Mala Triglavca, Slovenia. *Documenta Praehistorica*, 40., pp. 97-117.

Büller, H. (1983). Methodological problems in the microwear analysis of tools selected from the Natufian sites of El Wad and Aïn Mallaha. In Cauvin, M.C. (Ed.), *Traces d'utilisation sur les outils néolithiques du Proche Orient: Table ronde CNRS tenue à Lyon du 8 au 10 juin 1982 [Traces of use on Neolithic tools from the Near East: CNRS round table held in Lyon from June 8 to 10, 1982]*. Travaux de la Maison de 'Orient, 5. Lyon: Maison de 'Orient et de la Méditerranée Jean Pouilloux, pp. 107-125.

Burdo, N. and Videiko, M. (2015). Nebelivka: From Magnetic Prospection to New Features of Mega Sites. In Müller, J., Rassmann, K. and Videiko, M. (Eds.), *Trypillia Mega-Sites and European Prehistory: 4100-3400 BCE*. Abingdon-on-Thames: Routledge, pp. 95-116.

Burgert, P. (2018). The Status and the Role of 'Chocolate' Silicite in the Bohemian Neolithic. *Archaeologia Polona*, 56, pp. 49-64.

Buringh, R. (1960). *Soils and Soil Conditions in Iraq*. Baghdad: Ministry of Agriculture.

Butrimas, A. (2016). The Stone Age in West Lithuania. In Zabiela, G., Baubonis, Z. and Marcinkevičiūtė, E. (Eds.), *A Hundred Years of Archaeological Discoveries in Lithuania*. Vilnius: Lietuvos Archeologiijos Draugja, pp. 86-95.

Butrimas, A. (2018). *Amber Discs with cross decoration in the South Eastern Baltic*. Vilnius: Vilnius Academy of Arts Press.

Cadzow, D.A. (1920). *Native copper objects of the Copper Eskimo*. New York: Museum of the American Indian / Heye Foundation.

Callanan, M. (2013). Melting snow patches reveal Neolithic archery. *Antiquity*, 87, pp. 728-745.

Çamurcuoğlu, D.S. (2015). *The Wall Paintings of Çatalhöyük (Turkey): Materials, Technologies and Artists*. Unpublished: University College London. PhD.

Capelli, C., Starnini, E., Cabella, R. and Piazza, M. (2006). Archaeometric research on the Early Neolithic pottery production in Liguria (Northern Italy): preliminary data from San Sebastiano di Perti (Savona). *ArcheoSciences*, 30, Document 8. DOI: https://doi.org/10.4000/archeosciences.207.

Cârciumaru, M., Rodica-Mariana, I., Niţu, E.-C. and Ştefănescu, R. (2012). New evidence of adhesive as hafting material on Middle and Upper Palaeolithic artefacts from Gura Cheii-Râşnov Cave (Romania). *Journal of Archaeological Science*, 39 (7), pp. 1942-1950.

Carter, R. (2002) The Neolithic origins of seafaring in the Arabian Gulf. *Archaeology International*, 6, pp. 44-47.

Carter, R. (2002). Ubaid-period boat remains from As-Sabiyah: excavations by the British Archaeological Expedition to Kuwait. *Proceedings of the Seminar for Arabian Studies*, 32, pp. 13-30.

Carter, R. (2002). Ubaid-period boat remains from As-Sabiyah: excavations by the British Archaeological Expedition to Kuwait. *Proceedings of the Seminar for Arabian Studies*, 32, pp. 19-21.

Carter, R. (2006). Boat remains and maritime trade in the Persian Gulf during the sixth and fifth millennia BC. *Antiquity*, 80, pp. 52-63.

Carter, R. and Crawford, H. (2001). The Kuwait-British Archaeological Expedition to As-Sabiyah: Report on the Second Season's Work. *Iraq*, 63, pp. 1-20.

Carter, R. and Crawford, H. (2002). The Kuwait-British Archaeological Expedition to As-Sabiyah: Report on the Third Season's Work. *Iraq*, 64, pp. 1-13.

Carter, R. and Crawford, H. (2003). The Kuwait-British Archaeological Expedition to As-Sabiyah: Report on the Fourth Season's Work. *Iraq*, 65, pp. 77-90.

Casanova, E., Arbogast, R.-M., Denaire, A., Jeunesse, C., Lefranc, P. and Evershed, R.P. (2020). Spatial and temporal disparities in human subsistence in the Neolithic Rhineland gateway. *Journal of Archaeological Science*, 122, 105215.

Cattani, L. (1993). Contenuto pollinico di materiali resinosi come element di corredo funebre [Pollen content of resinous materials as an element of funeral equipment]. *Antropologia Contemporanea*, 16, pp. 55-60.

Caudullo, G., Welk, E. and San-Miguel-Ayanz, J. (2017). Chorological maps for the main European woody species. *Data in Brief*, 12, pp. 662-666.

Cauvin, J. (2003) [1994]. *The Birth of the Gods and the Origins of Agriculture*. Translated from French by Trevor Watkins. Cambridge: Cambridge University Press.

Cauvin, M.-C. (1973). Problèmes d'emmanchement des faucilles du Proche-Orient: les documents de Tell Assouad (Djezireh, Syrie) [Problems of fitting sickles from the Near East: the documents of Tell Assouad (Djezireh, Syria)]. *Paléorient*, 1 (1), pp. 101-106.

Cauvin, M.-C. (1983). Les faucilles préhistoriques du Proche-Orient données morphologiques et fonctionnelles [Prehistoric sickles from the Near East: morphological and functional data]. *Paléorient*, 9 (1), pp. 63-79.

César González-García, A., Vilas-Estévez, B., López-Romero, E. and Mañana-Borrazás, P. (2018). Domesticating Light and Shadows in the Neolithic: The Dombate Passage Grave (A Coruña, Spain). *Cambridge Archaeological Journal*, 29 (2), pp. 327-343.

Chalmin, E., Menu, M. and Vignaud, C. (2003). Analysis of rock art painting and technology of Palaeolithic painters. *Measurement Science and Technology*, 14, pp. 1590-1597.

Chamot-Rooke, J. (2001). A visit to the Louvre: the Laboratoire de Recherche des Musées de France. *European Journal of Mass Spectrometry*, 7 (4-5), pp. 299-302.

Chapman, J. (2002). Neolithic pottery at Polgar-10 (Hungary): measuring the habitus. *Documenta Praehistorica*, 29, pp. 127-144.

Chapple, R.M., Dunlop, C., Gilmore, S. and Heaney, L. (2009). *Archaeological Investigations along the A1 Dualling Scheme, Loughbrickland to Beech Hill, Co. Down, N. Ireland (2005).* BAR British Series, 479. Oxford: BAR Publishing.

Charniauski, M., Malyutina, A. and Lyashkevich, E. (2020). Fishing practices at the Kryvina Peat Bog as evidenced by the material culture of Asaviec 2 settlement (2008-2017 field seasons). *Quaternary International*, 541, pp. 52-62.

Charrié-Duhaut, A., Porraz, G., Cartwright, C.R., Igreja, M., Connan, J., Poggenpoel, C. and Texier, P.-J. (2013). First molecular identification of a hafting adhesive in the Late Howiesons Poort at Diepkloof Rock Shelter (Western Cape, South Africa). *Journal of Archaeological Science*, 40 (9), pp. 3506-3518.

Cherry, J.F., Davis, J.L., Demitrack, A., Mantzourani, E., Strasser, T.F. and Talalay, L.E. (1988). Archaeological Survey in an Artifact-Rich Landscape: A

Middle Neolithic Example from Nemea, Greece. *American Journal of Archaeology*, 92, pp. 159-176.

Chesnaux, L. (2009). Sauvterrian microliths: Evidence of the hunting weapons of the last hunter-gatherers of the northern Alps. *Palethnology*, 2009 #1, pp. 133-146.

Chmielewski, T.J., Sady, A., Goslar, T. Furmanek, M. and Juchelka, J. (2017). Seperating the wheat from the chaff: Dating charred plant remains extracted from daub (with reference to the 14C chronology of the Epi-Lengyel culture in Upper Silesia). *Radiocarbon*, 59 (1), pp. 251-268.

Chriazomenou, E., Papoulia, C. and Kopaka, K. (2014). Associating residues and wear traces as indicators of hafting methods: A view from the chipped stone industries from the island of Gavdos, Crete. In Marreiros, J., Bicho, N. and Gibaja-Bao, J. (Eds.), *International Conference on Use-Wear Analysis: Use-Wear 2012*. Newcastle upon Tyne: Cambridge Scholars Publishing, pp. 714-726.

Çilingiroğlu, A., Derin, Z., Abay, E., Saglamtimur, H. and Kayan, I. (2004). *Ulucak Höyük: Excavations Conducted Between 1995 and 2002*. Ancient Near Eastern Studies, 15. Herent: Peeters Publishers.

Civeyrel, L., Leclercq, J., Demoly, J.-P., Agnan, Y., Quèbre, N., Pélissier, C. and Otto, T. (2011). Molecular systematics, character evolution, and pollen morphology of Cistus and Halimium (Cistaceae). *Plant Systematics and Evolution*, 295, pp. 23-54.

Clark, A.M.B. (1999). Late Pleistocene Technology at Rose Cottage Cave: A Search for Modern Behavior in an MSA Context. *African Archaeological Review*, 16 (2), pp. 93-119.

Clark, J.G.D., Walker, D., Corner, E.J.H., Fraser, F.C. and King, J.E. (1950). Preliminary Report on Excavations at Star Carr, Seamer, Scarborough, Yorkshire (Second Season, 1950). *Proceedings of the Prehistoric Society*, 16, pp. 109-129.

Clarke, J. and Wasse, A. (2019). Time out of joint: A re-assessment of the Cypriot Aceramic Neolithic site of Kalavasos-Tenta and its regional implications. *Levant*, 51 (1), pp. 26-53.

Clarkson, C., Jacobs, Z., Marwick, B., Fullagar, R., Wallis, L., Smith, M., Roberts, R.G., Hayes, E., Lowe, K., Carah, X., Florin, S.A., McNeil, J., Cox, D., Arnold, L.J., Hua, Q., Huntley, J., Brand, H.E.A., Manne, T., Fairbairn, A., Shulmeister, J., Lyle, L., Salinas, M., Page, M., Connell, K., Park, G., Norman, K., Murphy, T. and Pardoe, C. (2017). Human occupation of northern Australia by 65,000 years ago. *Nature*, 547 (7663), pp. 306-310.

Clarkson, C., Petraglia, M., Korisettar, R., Haslam, M., Boivin, N., Crowther, A., Ditchfield, P., Fuller, D., Miracle, P., Harris, C., Connell, K., James, H. and Koshy, J. (2009). The oldest and longest enduring microlithic sequence in India: 35 000 years of modern human occupation and change at the Jwalapuram Locality 9 rockshelter. *Antiquity*, 83, pp. 326-348.

Clarkson, C., Smith, M.A., Marwick, B., Fullagar, R., Wallis, L.A., Faulkner, P., Manne, T., Hayes, E., Roberts, R.G., Jacobs, Z., Carah, X., Lowe, K.M., Matthews, J. and Florin, S.A. (2015). The archaeology, chronology and stratigraphy of Madjedbebe (Malakunanja II): a site in northern Australia with early occupation. *Journal of Human Evolution*, 83, pp. 46-64.

Clottes, J. (1993). Paint Analyses from Several Magdalenian Caves in the Ariège Region of France. *Journal of Archaeological Science*, 20 (2), pp. 223-235.

Coles, J.M., Hibbert, F.A. and Orme, B.J. (1973). Prehistoric Roads and Tracks in Somerset, England: 3. The Sweet Track. *Proceedings of the Prehistoric Society*, 39, pp. 256-293.

Conard, N.J., Bretzke, K., Deckers, K., Masri, M., Napierala, H., Riehl, S., Stahlschmidt, M. and Kandel, A.W. (2013). Natufian Lifeways in the Eastern Foothills of the Anti-Lebanon Mountains. In Bar-Yosef, O. and Valla, F.R. (Eds.), *Natufian Foragers in the Levant: Terminal Pleistocene Social Changes in Western Asia*. Ann Arbor: International Monographs in Prehistory, pp. 1-16.

Connan, J. and Carter, R. (2007). A geochemical study of bituminous mixtures from Failaka and Umm an-Namel (Kuwait), from the Early Dilmun to the Early Islamic period. *Arabian Archaeology and Epigraphy*, 18, pp. 139-181.

Connan, J. and Van de Velde, T. (2010). An overview of bitumen trade in the Near East from the Neolithic (c.8000 BC) to the early Islamic period. *Arabian Archaeology and Epigraphy*, 21, pp. 1-19.

Connan, J., Carter, R., Crawford, H., Tobey, M., Charrié-Duhaut, A., Jarvie, D., Albrecht, P. and Norman, K. (2005). A comparative geochemical study of bituminous boat remains from H3, As-Sabiyah (Kuwait), and RJ-2, Ra's al-Jinz (Oman). *Arabian Archaeology and Epigraphy*, 16, pp. 21-66.

Connan, J., Kavak, O., Akin, E., Yalçin, M.N., Imbus, K. and Zumberge, J. (2006). Identification and origin of bitumen in Neolithic artefacts from Demirköy Höyük (8100 BC): Comparison with oil seeps and crude oils from southeastern Turkey. *Organic Geochemistry*, 37 (12), pp. 1752-1767.

Connan, J., Nieuwenhuyse, O.P., van As, A. and Jacobs, L. (2004). Bitumen in early ceramic art: Bitumen-painted ceramics from Late Neolithic Tell Sabi Abyad (Syria). *Archaeometry*, 46 (1), pp. 115-124.

Connan, J., Nissenbaum, A. and Dessort, D. (1995). Geochemical study of Neolithic “bitumen”-coated objects of the Nahal Hemar cave in the Dead Sea area. In Grimalt, J.O. and Dorronoso, C. (Eds.), *Organic Geochemistry: Developments and Applications*. San Sebastian: AIGOA, pp. 699-701.

Connan, J., Zumberge, J., Imbus, K. and Moghaddam, A. (2008). The bituminous mixtures of Tall-e Abu Chizan: A Vth millennium BC settlement in southwestern Iran. *Organic Geochemistry*, 39 (12), 1772-1789.

Copeland, L. and Verhoeven, M. (1996). Bitumen-Coated Sickle-Blade Elements at Tell Sabi Abyad II, Northern Syria. In Kozłowski, S.K. and Gebel, H.G.K. (Eds.), *Neolithic Chipped Stone Industries of the Fertile Crescent, and Their Contemporaries in Adjacent Regions: Proceedings of the Second Workshop on PPN Chipped Lithic Industries: Institute of Archaeology, Warsaw University, 3rd – 7th April, 1995*. Studies in Early Near Eastern

Production, Subsistence, and Environment, 3. Berlin: Ex Oriente, pp. 327-330.

Copley, M.S., Berstan, R., Mukherjee, A.J., Dudd, S.N., Straker, V., Payne, S. and Evershed, R.P. (2005). Dairying in antiquity. III. Evidence from absorbed lipid residues dating to the British Neolithic. *Journal of Archaeological Science*, 32, pp. 523-546.

Coqueugniot, E. (1983). Analyse tracéologique d'une série de grattoirs et herminettes de Mureybet, Syrie. In Cauvin, M.-C. (Ed.), *Traces d'utilisation sur les outils néolithiques du Proche Orient: Table ronde CNRS tenue à Lyon du 8 au 10 juin 1982 [Traces of use on Neolithic tools from the Near East: CNRS round table held in Lyon from June 8 to 10, 1982]*. Travaux de la Maison de l'Orient, 5. Lyon: Maison de l'Orient et de la Méditerranée Jean Pouilloux, pp. 163-172.

Cosac, M., Murătoreanu, G., Radu, A. and Ion, R. (2013). Arguments concerning the use of bitumen as adhesive for the hafting of some lithic tools from the early Bronze Age in the region of the Curvature Subcarpathians. *Annales d'Université Valahia Targoviste*, 15 (2), pp. 41-50.

Courel, B., Robson, H.K., Lucquin, A., Dolbunova, E., Oras, E., Adamczak, K., Andersen, S.H., Astrup, P.M., Charniauski, M., Czekaj-Zastawny, Ezepenko, I., Hartz, S., Kabaciński, J., Kotula, A., Kukawka, S., Loze, I., Mazurkevich, A., Piezonka, H., Piličiauskas, G., Sørensen, S.A., Talbot, H.M., Tkachou, A., Tkachova, M., Wawrusiewicz, A., Meadows, J., Heron, C.P. and Craig, O.E. (2020). Organic residue analysis shows sub-regional patterns in the use of pottery by Northern European hunter-gatherers. *Royal Society Open Science*, 7, 192016. DOI: https://dx.doi.org/10.1098/rsos.192016.

Courel, B., Schaeffer, P., Féliu, C., Thomas, Y. and Adam, P. (2018). Birch bark tar and jewellery: the case study of a necklace from the Iron age (Eckwersheim, NE France). *Journal of Archaeological Science: Reports*, 20, pp. 72-79.

Covello-Paran, K. (2019). The Pottery Neolithic settlement at Tel Yosef (Tell esh-Sheikh Hasan). *'Atiqot*, 95, pp. 1-28.

Crawford, J., Cowie, T., Finlayson, B., Lane, A., Sheridan, A. and Braby, A. (1997). Archaeological collections from sandhill sites in the Isle of Coll, Argyll & Bute. *Proceedings of the Society of Antiquaries of Scotland*, 127, pp. 467-511.

Cristiani, E., Dimitrijević, V. and Vitezović, S. (2016). Fishing with lure hooks at the Late Neolithic site of Vinča – Belo Brdo, Serbia. *Journal of Archaeological Science*, 65, pp. 134-147.

Cristiani, E., Lemorini, C. and Dalmeri, G. (2012). Ground stone tool production and use in the Late Upper Palaeolithic: The evidence from Riparo Dalmeri (Venetian Prealps, Italy). *Journal of Field Archaeology*, 37 (1), pp 34-50.

Cristiani, E., Pedrotti, A and Gialanella, S. (2009). Tradition and innovation between the Mesolithic and Early Neolithic in the Adige Valley (Northeast Italy). New data from a functional and residues analyses of trapezes from Gaban rockshelter. *Documenta Praehistorica*, 36, pp. 191-205.

Cristiani, E., Živaljević, I. and Borič, D. (2014). Residue analysis and ornament suspension techniques in prehistory: cyprinid pharyngeal teeth beads from Late Mesolithic burials at Vlasac (Serbia). *Journal of Archaeological Science*, 46, pp. 292-310.

Croft, S., Monnier, G., Radini, A., Little, A. and Milner, N. (2016). Lithic residue survival and characterisation at Star Carr: a burial experiment. *Internet Archaeology*, 42. DOI: https://doi.org/10.11141/ia.42.5.

Croft, S., Colonese, A.C., Lucquin, A, Craig, O.E., Conneller, C. and Milner, N. (2018). Pine traces at Star Carr: evidence from residues on stone tools. *Journal of Archaeological Science: Reports*, 21, pp. 21-31.

d'Errico, F., Backwell, L., Villa, P., Degano, I., Lucejko, J.J., Bamford, M.K., Higham, T.F.G., Colombini, M.P. and Beaumont, P.B. (2012). Early evidence of San material culture represented by organic artifacts from Border Cave, South Africa. *PNAS*, 109 (33), pp. 13214-13219.

Dag, D. and Goring-Morris, A.N. (2010). The Epi-Natufian Lithic Assemblage of Gilgal II. In Bar-Yosef, O., Goring-Morris, A.N. and Gopher, A. (Eds.), *Gilgal. Early Neolithic Occupations in the Lower Jordan Valley: The Excavations of Tamar Noy*. Oxford and Oakville: Oxbow Books, pp. 121-138.

Dag, D., Groman-Yaoslavski, I., Gopher, A. and Goring-Morris, A.N. (2010). The Gilgal I Lithic Assemblage. In Bar-Yosef, O., Goring-Morris, A.N. and Gopher, A. (Eds.), *Gilgal. Early Neolithic Occupations in the Lower Jordan Valley: The Excavations of Tamar Noy*. Oxford and Oakville: Oxbow Books, pp. 39-82.

David, É. (2018). A Late Mesolithic ritual using fishing tools at Kanaljordan (Sweden), 5700 Cal BC. *Quaternary International*, 472, pp. 23-37.

Davies, S.R. (2009). Location, Location, Location: A landscape based study of early Neolithic longhouses in Britain. *Rosetta*, 7, pp. 57-101.

De Pauw, E., Oweis, T., Nsier, B. and Youssef, J. (2008). *Spatial Modeling of the Biophysical Potential for Supplemental Irrigation*. Aleppo: ICARDA.

de Senna-Martinez, J.C. (2018). A shrine in the Neolithic? Orca da Lapa do Lobo, Nelas (C. 5000-3000 BC). In Senna-Martinez, J.C., Diniz, M. and Carvalho, A.F. (Eds.), *De Gibraltar aos Pirenéus: Megalitismo, Vida e Morte na Fachada Atlântica Peninsular*. Nelas: Grafinelas, pp. 167-182.

Decavallas, O. (2007). Beeswax in Neolithic Perforated Sherds from the Northern Aegean: New economic and functional implications. In Mee, C. and Renard, J. (Eds.), *Cooking up the Past: Food and Culinary Practices in the Neolithic and Bronze Age Aegean*. Oxford: Oxbow Books, pp. 148-157.

Defrasne, C., Chalmin, E., Bellot-Gurlet, L., Thirault, E. and André, G. (2019). From archeological layers to schematic rock art? Integrated study of the Neolithic pigments and pigmented rocks at the Rocher du Château (Western Alps, Savoie, France). *Archaeological and Anthropological Sciences*, 11, pp. 6065-6091.

Degano, I., Soriano, S., Villa, P., Pollarolo, L., Lucejko, J.J., Jacobs, Z., Douka, K., Vitagliano, S and Tozzi, C. (2019). Hafting of Middle Paleolithic tools in

Latium (central Italy): New data from Fossellone and Sant'Agostino caves. *PLoS ONE*, 14 (10), e0223714. DOI: https://doi.org/10.1371/journal.pone.0223714.

Delagnes, A., Wadley, L., Villa, P. and Lombard, M. (2006). Crystal quartz backed tools from the Howiesons Poort at Sibudu Cave. *Southern African Humanities*, 18 (1), pp. 43-56.

Delplancke, M., Yazbek, M., Arrigo, M., Espíndola, A., Joly H. and Alvarez, N. (2016). Combining conservative and variable markers to infer the evolutionary history of Prunus subgen. Amygdalus s.l. under domestication. *Genetic Resources and Crop Evolution*, 63, pp. 221-234.

Di Lerna, S., Fiorentino, G., Galiberti, A. and Basili, R. (1995). The Early Neolithic mine of Defensola "A" (I 18): flint exploitation in the Gargano area. *Archaeologia Polonia*, 33, pp. 119-132.

Di Pascale, A. (2018). Un modèle original de toiture de terre crue à la Préhistoire récente: le cas du site de La Capoulière (Mauguio, Hérault) [An original model of a mud roof in recent prehistory: the case of the site of La Capoulière (Mauguio, Hérault)]. In de Chazelles, C.-A., Leal, É. and Klein, A. (Eds.), *Construction en terre crue: Torchis, techniques de garnissage et de finition Architecture et mobilier: Échanges transdisciplinaires sur les constructions en terre crue Volume 4: Actes de la table ronde internationale de Lattes 23-25 novembre 2016 [Raw earth construction: Cob, filling and architectural finishing techniques: Transdisciplinary exchanges on raw earth constructions Volume 4: Proceedings of the Lattes international round table 23-25 November 2016].* Montpellier: Éditions de l'Espérou, pp. 207-214.

Diachenko, A., Stróżyk, M., Szmyt, M. and Żurkiewicz, D. (2021). Why do we need to weigh burned daub? Destruction of wattle-and-daub houses and the internal chronology of Neolithic sites. *Journal of Archaeological Science: Reports*, 38, 103052.

Diana, A., Boroneanţ, A., Bălășescu, A., Sava, T. and Bonsall, C. (2019). Early Neolithic burials from Grumăzeşti – Deleni, Neamţ County, Romania. *Materiale şi Cercetări Arheologice*, 15 (1), 15-25.

Dietrich, O. and Schmidt, K.A. (2010). Radiocarbon Date from the Wall Plaster of Enclosure D of Göbekli Tepe. *Neo-Lithics*, 2/10, pp. 82-83.

Dietrich, O., Notroff, J. and Dietrich, L. (2018). Masks and masquerade in the Early Neolithic: A view from Upper Mesopotamia. *Time and Mind*, 11 (1), pp. 3-21.

Dinnis, R., Pawlik, A. and Gaillard, C. (2009). Bladelet cores as weapon tips? Hafting residue identification and micro-wear analysis of three carinated burins from the late Aurignacian of Les Vachons, France. *Journal of Archaeological Science*, 36 (9), pp. 1922-1934.

Domboróczki, L. (2001). The excavation at Füzesabony-Gubakút: Preliminary Report. In Kertész, R. and Makkay, J. (Eds.), *From the Mesolithic to the Neolithic: Proceedings of the International Archaeological Conference held in the Damjanich Museum of Szolnok, September 22-27, 1996*. Budapest: Archaeolingua, pp. 193-214.

Domboróczki, L. (2010). Report on the excavation at Tiszaszőlős–Domaháza-Puszta and a new model for the spread of the Körös Culture. In Kozłowski, J.K. and Raczky, P. (Eds.), *Neolithization of the Carpathian Basin: Northernmost Distribution of the Starčevo/Körös Culture*. Kraków: Polska Akademia Umiejętności, pp. 137-176.

Drașovean, F., Schier, W., Bayliss, A., Gaydarska, B. and Whittle, A. (2017). The Lives of Houses: Duration, Context, and History at Neolithic Uivar, Romania. *European Journal of Archaeology*, 20 (4), pp. 636-662.

Drieu, L., Mirabaud, S., Roffet-Salque, M., Blasco, T., Pétrequin, P., Pétrequin, A.-M., Evershed, R.P. and Regert, M. (2020). Defining pottery use and exploitation of natural products at Clairvaux XIV during the Middle Neolithic. In Hafner, A., Dolbunova, E., Mazurkevich, A., Pranckenaite, E. and Hinz, M. (Eds.), *Settling Waterscapes in Europe: The Archaeology of*

Neolithic and Bronze Age Pile-Dwellings. Open Series in Prehistoric Archaeology, 1. Berg and Heidelberg: Propyleaum, pp. 251-274.

Dubreuil, L., Ovadia, A., Shahack-Gross, R. and Grosman, L. (2019). Evidence of ritual breakage of a ground stone tool at the Late Natufian site of Hilazon Tachtit cave (12,000 years ago). *PLoS ONE*, 14 (10), e0223370. DOI: https://doi.org/10.1371/journal.pone.0223370.

Duistermaat, K. and Scheider, G. (1998). Chemical analyses of sealing clays and the use of administrative artefacts at Late Neolithic Tell Sabi Abyad (Syria). *Paléorient*, 24 (1), pp. 89-106.

Ebnesajjad, S. and Landrock, A.H. (2014). *Adhesives Technology Handbook: Third Edition*. Waltham: William Andrew.

Edwards, P.C. and Schmidt, A. (2021). A geophysical survey at Zahrat adh-Dhra‘ 2 and its implications for Pre-Pottery Neolithic A architectural traditions in the southern Levant. *Jordan Journal for History and Archaeology*, 15 (1), pp. 107-137.

Efstratiou, N. (2010). Neolithic tells and archaeological narratives – uncovering 6th Millennium Makri in Greek Thrace. In Hansen, S. (Ed.), *Leben auf dem Tell als soziale Praxis: Beiträge des internationalen Symposiums in Berlin vom 26.–27. Februar 2007 [Life on the Tell as a social practice: Contributions from the international symposium in Berlin from 26.-27. February 2007]*. Bonn: Habelt-Verlag, pp. 45-53.

Elburg, R. and Stäuble, H. (2011). Des fenêtres sur le passé: Les vestiges découverts dans les puits du Néolithique [Windows on the past: Remains discovered Neolithic wells]. In Hauzeur, A., Jadin, I. and Jungels, C. (Eds.), *5000 ans avant J-C, La grande migration?: Le Néolithique ancien dans la collection Louis Éloy [5000 BC, The Great Migration?: The Early Neolithic in the Louis Éloy collection]*. Brussels: Institut du Patrimoine Wallon, pp. 149-154.

Erdal, Y.S. (2015). Bone or Flesh: Defleshing and Post-Depositional Treatments at Körtik Tepe (Southeastern Anatolia, PPNA Period). European *Journal of Archaeology*, 18 (1), pp. 4-32.

Erdoğu, B. (2017). A preliminary report on the earliest Neolithic levels at Uğurlu on the island of Gökçeada. *Anatolica*, 43, pp. 71-82.

Eres, Z. and Özdoğan, E. (2012). A New Approach in Studying the Structural Systems of Prehistoric Wooden Post Buildings: A Case Study from Aşaği Pinar in Eastern Thrace. In Carvais, R., Guillerme, A., Negre, V. and Sakarovitch, J. (Eds.), *Nuts & Bolts of Construction History Culture, Technology and Society, Vol. 3*. Paris: Picard, pp. 149-156.

Erol, F. (2019). *Examinations on technological characteristics of mud-based construction materials in Ulucak Hoyuk Neolithic settlement.* Unpublished: Middle East Technical University. PhD.

Escudero, A., Palacio, S., Maestre, F.T. and Luzuriaga, A. (2014). Plant life on gypsum: A review of its multiple facets. Biological Reviews of the *Cambridge Philosophical Society*, 90 (1), pp. 1-18.

Estreicher, S.K. (2006). *Wine: From Neolithic Times to the 21st Century*. New York: Algora Publishing.

Evans, K. and Heron, C. (1993). Glue, Disinfectant and Chewing Gum: Natural Products Chemistry in Archaeology. *Chemistry and Industry*, 12, pp. 446-449.

Evershed, R.P., van Bergen, P.F., Peakman, T.M., Leigh-Firbank, E.C., Horton, M.C., Edwards, D., Biddle, M., Kjølbye-Biddle, B. and Rowley-Conwy, P.A. (1997). Archaeological frankincense. *Nature*, 390, pp. 667-668.

Feldman, D. (1989) [2003]. *Polymeric Building Materials*. Boca Raton: CRC Press.

Fiedel, S.J. (1996). Blood from Stones? Some Methodological and Interpretive Problems in Blood Residue Analysis. *Journal of Archaeological Science*, 23, pp. 139-147.

Filipovic, D. and Maric, M. (2013). *Finds of wild pear from Late Neolithic Vinča, Serbia*. Poster Presented at the 16th Conference of the International Work Group for Palaeoethnobotany, June 2013, Thessaloniki, Greece. Book of Abstracts, p. 198.

Finlayson, B., Mithen, S. and Najjar, M. (2012). WF16. Architecture, Sedentism and Social Complexity Communal Building in Pre-Pottery Neolithic A Settlements: New Evidence from WF16. *Bulletin for the Council for British Research in the Levant*, 7 (1), pp. 18-23.

Finlayson, B., Mithen, S.J., Najjar, M., Smith, S., Maričević, D., Pankhurst, N. and Yeomans, L. (2011). Architecture, sedentism, and social complexity at Pre-Pottery Neolithic A WF16, Southern Jordan. *PNAS*, 108 (20), pp. 8183-8188.

Fisher, L.W. (2005). *Selection of Engineering Materials and Adhesives*. Boca Raton: CRC Press.

Flohr, P., Finlayson, B., Najjar, M. and Mithen, S. (2015). Building WF16: construction of a Pre-Pottery Neolithic A (PPNA) pisé structure in Southern Jordan. *Levant*, 47 (2), pp. 143-163.

Fontana, F., Cristiani, E., Bertola, S., Briols, F., Guerreschi, A. and Ziggiotti, S. (2020). A snapshot of Late Mesolithic life through death: An appraisal of the lithic and osseous grave goods from the Castelnovian burial of Mondeval de Sora (Dolomites, Italy). *PLoS ONE*, 15 (8), e0237573. DOI: https://doi.org/10.1371/journal.pone.0237573.

Fortin, M. (1994). Rapport préliminaire sur la quatrième campagne à Tell 'Atij et la troisième à Tell Gudeda (printemps 1992) [Preliminary report on the fourth campaign at l 'Atij and the third at Tell Gudeda (spring 1992)]. *Syria: Archéologie, Art et Histoire*, 71-3-4, pp. 361-396.

Frierman, J.D. (1971). Lime Burning as the Precursor of Fired Ceramics. *Israel Exploration Journal*, 21 (4), pp. 212-216.

Friesem, D.E., Abadi, I., Shaham, D. and Grosman, L. (2019). Lime plaster cover of the dead 12,000 years ago – new evidence for the origins of lime plaster technology. *Evolutionary Human Sciences*, 1, e9. DOI: https://doi.org/10.1017/ehs.2019.9.

Fuchs, C. and Wahl, J. (2013). Kaugummi oder Werkstoff? Birkenpechstücke aus der Pfahlbausiedlung Hornstaad-Hörnle am Bodensee [Chewing gum or material? Pieces of birch pitch from the Hornstaad-Hörnle pile dwelling on Lake Constance]. *Denkmalpflege in Baden-Württemberg–Nachrichtenblatt der Landesdenkmalpflege*, 42 (2), pp. 240-245.

Fullagar, R. and David, B. (2008). Investigating Changing Attitudes Towards an Australian Aboriginal Dreaming Mountain Over >37,000 Years of Occupation via Residue and Use Wear Analyses of Stone Artefacts. *Cambridge Archaeological Journal*, 7 (1), pp. 139-144.

Galili, E., Horwitz, L.K., Eshed, V., Rosen, B. and Hershkovitz, I. (2013). Submerged prehistoric settlements off the Mediterranean coast of Israel. *Skyllis*, 2, pp. 181-204.

Garfinkel, Y. (1985). Preliminary Report on the Excavations of the Neolithic Layers at Yiftahel, Area C. *Mitekufat Haeven, Journal of the Israel Prehistoric Society*, 18, pp. 45-51.

Garfinkel, Y. (1987). Yiftahel: A Neolithic Village from the Seventh Millennium B.C. in Lower Galilee, Israel. *Journal of Field Archaeology*, 14 (2), pp. 199-212.

Garnier, N. and Valamoti, S.M. (2016). Prehistoric wine-making at Dikili Tash (Northern Greece): Integrating residue analysis and archaeobotany. *Journal of Archaeological Science*, 74, pp. 195-206.

Garrard, A. and Yazbeck, C. (2013). The Natufian of Moghr el-Ahwal in the Qadisha valley, northern Lebanon. In Bar-Yosef, O. and Valla, F.R. (Eds.), *Natufian Foragers in the Levant: Terminal Pleistocene Social Changes in Western Asia*. Ann Arbor: International Monographs in Prehistory, pp. 17-27.

Gay, M., Alfeld, M., Menu, M., Laval, E., Arias, P. and Reiche, I. (2015). Palaeolithic paint palette used at La Garma cave (Cantabria, Spain) investigated by means of high-resolution micro-XRF and XANES at the Fe K-edge. *Journal of Analytical Atomic Spectrometry*, 30 (3), pp. 767-776.

Gayton, A.H. (1948). *Yokuts and Western Mono Ethnography. Vol. 1: Tulare Lake, Southern Valley, and Central Foothill Yokuts*. Berkeley: University of California Press.

Gebel, H.G.K. and Hermansen, B.D. (2005). Ba'ja 2003: Summary on the 5th Season of Excavation. *Neo-Lithics*, 2/04, pp. 15-18.

Gebel, H.G.K. and Kinzel, M. (2007). Ba'ja 2007: Crawl Spaces, Rich Room Dumps, and High Energy Events. Results of the 7th Season of Excavations. *Neo-Lithics*, 1/07, pp. 24-33.

Gebel, H.G.K., Hermansen, B.D. and Kinzel, M. (2006). Ba'ja 2005: A Two-Storied Building and Collective Burials. Results of the 6th Season of Excavation. *Neo-Lithics*, 1/06, pp. 12-19.

Gencheva, J. (1992). White Incrustation on Pottery from Neolithic Tell Samovodene, Bulgaria. *MRS Proceedings*, 267, pp. 639-649.

Gervasoni, J.P. (1999). *A chipped stone characterization of Ghwair I: A Neolithic village in southern Jordan*. Unpublished: University of Pittsburgh. PhD.

Giacobini, G. (2007). Richness and Diversity of Burial Rituals in the Upper Paleolithic. *Diogenes*, 214, pp. 19-39.

Gibaja, J.F., Ibáñeza, J.J., Nielsen, E., Kienholz, A., van Willigen, S. and Linton, J. (2017). The Neolithic reaping knives from Egolzwil 3: A Mediterranean technical tradition in the late 5th millennium Swiss Neolithic. *Quaternary International*, 427 (B), pp. 211-224.

Gibson, A., Neubauer, W., Flöry, S., Filzweiser, R., Nau, E., Scheidhofer, P., Strapazzon, G., Batt, C., Greenwood, D., Bradley, P. and Challinor, D. (2017). Excavation of a Neolithic House at Yarnbury, near Grassington, North Yorkshire. *Proceedings of the Prehistoric Society*, 83, pp. 189-212.

Gliozzo, E., Pizzo, A. and La Russa, M.F. (2021). Mortars, plasters and pigments – research questions and sampling criteria. *Archaeological and Anthropological Sciences*, 13, 193. DOI: https://doi.org/10.1007/s12520-021-01393-2.

Godleman, J., Almond, M.J. and Matthews, W. (2016). An infrared microspectroscopic study of plasters and pigments from the Neolithic site of Bestansur, Iraq. *Journal of Archaeological Science: Reports*, 7, pp. 195-204.

Golan, A. (2009). Bridging the gap between ethnobotany and biotechnology of Pistacia. *Israel Journal of Plant Sciences*, 57 (1), pp. 65-78.

Goldman, G. and Szénászky, J.G. (1994). Die neolitische Esztár-Gruppe in Ostungarn [The Neolithic Esztár Group in Eastern Hungary]. *Jósa András Múzeum Évkönyve*, 36, pp. 225-230.

Gopher, A. (1989). Horvat Galil and Nahal Betzet I: Two Neolithic Sites in the Upper Galilee. *Mitekufat Haeven: Journal of the Israel Prehistoric Society*, 22, pp. 82-92.

Gopher, A. (1997). Horvat Galil – an Early PPNB Site in the Upper Galilee, Israel. *Tel Aviv*, 24 (2), pp. 183-222.

Gopher, A., Eirikh-Rose, A., Ashkenazi, H., Marco, E., May, H., Makoviychuk, Y., Sapir-Hen, L., Galmor, S., Schechter, H.C., Ackerfeld, H., Haklay, G. and Zutovski, K. (2019). Nahal Yarmuth 38: a new and unique Pre-Pottery Neolithic B site in central Israel. *Antiquity*, 93 (371), e29. DOI: https://doi.org/10.15184/aqy.2019.162.

Gopher, A., Lemorini, C., Boaretto, E., Carmi, I., Barkai, R. and Schechter, H.C. (2013). Qumran Cave 24, a Neolithic-Chalcolithic site by the Dead Sea: a short report and some information on lithics. In Borrell, F., Ibáñez, J.J. and Molist, M. (Eds.), *Stone Tools in Transition: From Hunter-Gatherers to Farming Societies in the Near East*. Barcelona: Universitat Autònoma de Barcelona, pp. 101-113.

Goren, Y. and Goldberg, P. (1991). Special Studies: Petrographic Thin Sections and the Development of Neolithic Plaster Production in Northern Israel. *Journal of Field Archaeology*, 18 (1), pp. 131-140.

Goren, Y. and Goring-Morris, A.N. (2008). Early Pyrotechnology in the Near East: Experimental Lime-Plaster Production at the Pre-Pottery Neolithic B Site of Kfar HaHoresh, Israel. *Geoarchaeology: An International Journal*, 23 (6), pp. 779-798.

Goren, Y. and Segal, I. (1995). On Early Myths and Formative Technologies: A Study of Pre-Pottery Neolithic B Sculptures and Modeled Skulls From Jericho. *Israel Journal of Chemistry*, 35 (2), pp. 155-165.

Goren, Y., Goring-Morris, A.N. and Segal, I. (2001). The Technology of Skull Modelling in the Pre-Pottery Neolithic B (PPNB): Regional Variability, the Relation of Technology and Iconography and their Archaeological Implications. *Journal of Archaeological Science*, 28 (7), pp. 671-690.

Goren, Y., Segal, I. and Bar-Yosef, O. (1993). Plaster Artifacts and the Interpretation of the Nahal Hemar Cave. *Mitekufat Haeven: Journal of the Israel Prehistoric Society*, 25, pp. 120-131.

Goring-Morris, A.N., Goldberg, P., Goren, Y., Baruch, U. and Bar-Yosef, D.E. (1999). Saflulim: A Late Natufian Base Camp in the Central Negev Highlands, Israel. *Palestine Exploration Quarterly*, 131 (1), pp. 36-64.

Goring-Morris, A.N., Goren, Y., Horwitz, L.K., Hershkovitz, I., Lieberman, R., Sarel, J. and Bar-Yosef, D. (1994-5). The 1992 Season of Excavations at the Pre-Pottery Neolithic B Settlement of Kfar Hahoresh. *Mitekufat Haeven: Journal of the Israel Prehistoric Society*, 26, pp. 74-121.

Goring-Morris, N. (1991). A PPNB Settlement at Kfar Hahoresh in Lower Galilee: A Preliminary Report of the 1991 Season. *Mitekufat Haeven: Journal of the Israel Prehistoric Society*, 24, pp. 77-101.

Goring-Morris, N. and Horwitz, L.K. (2007). Funerals and feasts during the Pre-Pottery Neolithic B of the Near East. *Antiquity*, 81, pp. 902-919.

Gourdin, W.H. and Kingery, W.D. (1975). The Beginnings of Pyrotechnology: Neolithic and Egyptian Lime Plaster. *Journal of Field Archaeology*, 2 (1-2), pp. 133-150.

Greenfield, H.J. (2000). Integrating Surface and Subsurface Reconnaissance Data in the Study of Stratigraphically Complex Sites: Blagotin, Serbia. *Geoarchaeology: An International Journal*, 15 (2), pp. 167-201.

Greenfield, H.J. and Jongsma-Greenfield, T.L. (2018). Feasting during the Early Neolithic of the central Balkans: The fauna from Blagotin, Serbia. In

Ivanova, M., Athanassov, B., Petrova, V., Takorova, D. and Stockhammer, P.W. (Eds.), *Social Dimensions of Food in the Prehistoric Balkans*. Oxford: Oxbow Books, pp. 109-140.

Greenfield, H.J., Jongsma-Greenfield, T.L. and Jezik, S. (2014). Subsistence and Settlement in the Early Neolithic of Temperate SE Europe: A View from Blagotin, Serbia. *Archaeologia Bulgarica*, 18 (1), pp. 1-33.

Gregg, M.W. (2009). *Organic residue analysis and the earliest uses of pottery in the ancient Middle East*. Unpublished: University of Toronto. PhD.

Gregg, M.W., Brettell, R. and Stern, B. (2007). Bitumen in Neolithic Iran: Biomolecular and Isotopic Evidence. In Glascock, M.D., Speakman, R.J. and Popelka-Filcoff, R.S. (Eds.), *Archaeological Chemistry: Analytical Techniques and Archaeological Interpretation*. ACS Symposium Series, 968. Washington DC: American Chemical Society, pp. 137-151.

Griffin, P.S., Grissom, C.A. and Rollefson, G.O. (1998). Three late eighth millennium plastered faces from 'Ain Ghazal, Jordan. *Paléorient*, 24 (1), pp. 59-70.

Grigorescu, E. (2020). Middle Neolithic at Oradea-Salca “Pepinieră”. *Studia Archaeologica*, 34, pp. 7-24.

Grissom, C.A. (2000). Neolithic Statues from ‘Ain Ghazal: Construction and Form. *American Journal of Archaeology*, 104, pp. 25-45.

Groom, P., Schenck, T. and Pedersen, G.M. (2013). Experimental explorations into the aceramic dry distillation of Betula pubescens (downy birch) bark tar. *Archaeological and Anthropological Sciences*, 7 (1), pp. 47-58.

Grosman, L. and Munro, N.D. (2016). A Natufian Ritual Event. *Current Anthropology*, 57 (3), pp. 311-331.

Grosman, L., Munro, N.D. and Belfer-Cohen, A. (2008). A 12,000-year-old Shaman burial from the southern Levant (Israel). *PNAS*, 105 (46), pp. 17665-17669.

Grosman, L., Munro, N.D., Abadi, I., Boaretto, E., Shaham, D., Belfer-Cohen, A. and Bar-Yosef, O. (2016). Nahal Ein Gev II, a Late Natufian Community at the Sea of Galilee. *PLoS ONE*, 11 (1), e0146647. DOI: https://doi.org/10.1371/journal.pone.0146647.

Grosman, L., Raz, T. and Friesem, D.E. (2020). Tomorrow's mundane is today's extraordinary: A case study of a plastered installation during Neolithization. *Humanities and Social Sciences Communications*, 7 (87), pp. 1-13.

Gross-Klee, E. and Hochuli, S. (2002). Die jungsteinzeitliche Doppelaxt von Cham-Eslen. Gesamtbericht über einen einzigartigen Fund aus dem Zugersee [The Neolithic double ax from Cham-Eslen. General report on a unique find from Lake Zug]. *Tugium*, 18, 69-101.

Grünberg, J.M. (2002). Middle Palaeolithic birch-bark pitch. *Antiquity*, 76, pp. 15-16.

Guilbeau, D., Kayacan, N., Altınbilek-Algül, Ç., Erdoğu, B. and Çevik, Ö. (2019). A comparative study of the Initial Neolithic chipped-stone assemblages of Ulucak and Uğurlu. *Anatolian Studies*, 69, pp. 1-20.

Guinard, M. and Knutsson, H. (2019). The Huddunge scraper - The Rise and Fall of a Tool. Traces of a Widespread Late Mesolithic Network. In N. Stenbäck and T. Carlsson (Eds.), *Stone Age studies from the Northern part of Uppland, Sweden*. Uppsala: Societas Archaeologica Upsaliensis and Stiftelsen Kulturmiljövård, pp. 79-116.

Guo, M. and Wang, G. (2016). Milk protein polymer and its application in environmentally safe adhesives. *Polymers*, 8 (9), 324. DOI: https://doi.org/doi:10.3390/polym8090324.

Gyucha, A., Yerkes, R.W., Parkinson, W.A,, Sarris, A., Papadopoulos, N., Duffy, P.R. and Salisbury, R.B. (2015). Settlement Nucleation in the Neolithic: A Preliminary Report of the Körös Regional Archaeological Project's Investigations at Szeghalom-Kovácshalom and Vésztő-Mágor. In Hansen, S. (Eds.), *Neolithic and Copper Age between the Carpathians and the Aegean*

Sea: Chronologies and Technologies from the 6th to the 4th Millennium BCE. Bonn: Habelt-Verlag, pp. 129-142.

Haddow, S.D. and Knüsel, C.J. (2017). Skull Retrieval and Secondary Burial Practices in the Neolithic Near East: Recent Insights from Çatalhöyük, Turkey. *Bioarchaeology International*, 1 (1-2), pp. 52-71.

Haită, C. (2001). Preliminary considerations on a sedimentary sondage performed on the Eneolithic tell from Bucşani. *Studii de Preistorie*, 1/2001, pp. 147-151.

Haller, I., Decavallas, O. and Regert, M. (2006). Revealing pottery function by investigating its organic content: New results obtained on the Neolithic site of Bercy (Paris, France). In Saunders, D., Townsend, J., Woodcock, S., Krekel, C. and Haller, U. (Eds.), *The Object in Context: Crossing Conservation Boundaries: Contributions to the Munich Congress, 28 August – 1 September 2006*. London: International Institute of Conservation of Historic and Artistic Works, p. 323.

Hamm, G., Mitchell, P., Arnold, L.J., Prideau, G.J., Questiaux, D., Spooner, N.A., Levchenko, V.A., Foley, E.C., Worthy, T.H., Stephenson, B., Coulthard, V., Coulthard, C., Wilton, S. and Johnston, D. (2016). Cultural innovation and megafauna interaction in the early settlement of arid Australia. *Nature*, 539, pp. 280-283.

Hardy, B.L. (1999). Preliminary results of residue and use-wear analyses of stone tools from two Mesolithic sites, northern Bohemia, Czech Republic. *Archaeologicke Rozhledy*, 51, pp. 274-279.

Hardy, B.L. and Svoboda, J.A. (2009). Mesolithic stone tool function and site types in Northern Bohemia, Czech Republic. In Haslam, M., Robertson, G., Crowther, A., Nugent, S. and Kirkwood, L. (Eds.), *Archaeological Science under a Microscope: Studies in Residue and ancient DNA analysis in Honour of Thomas H. Loy*. Canberra: ANU E Press, pp. 159-174.

Hardy, B.L., Kay, M., Marks, A.E. and Monigal, K. (2001). Stone tool function at the paleolithic sites of Starosele and Buran Kaya III, Crimea: Behavioral implications. *PNAS*, 98 (19), pp. 10972-10977.

Hartshorn, S.R. (1986). *Structural Adhesives: Chemistry and Technology*. New York: Plenum Press.

Hauck, T.C., Connan, J., Charrié-Duhaut, A., Le Tensorer, J.-M. and al Sakhel, H. (2013). Molecular evidence of bitumen in the Mousterian lithic assemblage of Hummal (Central Syria). *Journal of Archaeological Science*, 40 (8), pp. 3252-3262.

Haug Røe, E. (2015). *Maintaining craftsmanship: An investigation of the organisation of Middle Mesolithic blade technology at Hovland 3 in Vestfold, south-eastern Norway*. Unpublished: University of Oslo. MA.

Hauptmann, A. and Yalcin, Ü. (2000). Lime plaster, cement and the first puzzolanic reaction. *Paléorient*, 26 (2), pp. 61-88.

Hayek, E.W.H., Krenmayr, P., Lohninger, H., Jordis, U., Moche, W. and Sauter, F. (1990). Identification of Archaeological and Recent Wood Tar Pitches Using Gas Chromatography/Mass Spectrometry and Pattern Recognition. *Analytical Chemistry*, 62, pp. 2038-2043.

Hedges, R.E.M. (1990). A review of the application of AMS-14C dating to archaeology. *Nuclear Instruments and Methods in Physics Research*, B52, pp. 428-432.

Hein, F.J., Leckie, D., Larter, S. and Suter, J.R. (2013). Heavy Oil and Bitumen Petroleum Systems in Alberta and Beyond: The Future Is Nonconventional and the Future Is Now. In Hein, F.J., Leckie, D., Larter, S. and Suter, J.R. (Eds.), *Heavy-oil and oil-sand petroleum systems in Alberta and beyond*. AAPG Studies in Geology, 64. Tulsa: AAPG, pp. 1-21.

Helwig, K., Monahan, V., Poulin, J. and Andrews, T.D. (2014). Ancient projectile weapons from ice patches in northwestern Canada: identification of resin and compound resin-ochre hafting adhesives. *Journal of Archaeological Science*, 41, pp. 655-665.

Hems, E.S. and Curtis, A.E. (2015). Decolourising isinglass derived from aqua-farmed sturgeon by sonication. *Journal of the Institute of Conservation*, 38 (2), pp. 188-199.

Hennius, A. (2018). Viking Age tar production and outland exploitation. *Antiquity*, 92 (365), pp. 1349-1361.

Henry, D.O. and Garrard, A.N. (1988). Tor Hamar: An Epipaleolithic Rockshelter in Southern Jordan. *Palestine Exploration Quarterly*, 120 (1), pp. 1-25.

Henshilwood, C.S., d'Errico, F. and Watts, I. (2009). Engraved ochres from the Middle Stone Age levels at Blombos Cave, South Africa. *Journal of Human Evolution*, 57 (1), pp. 27-47.

Henshilwood, C.S., d'Errico, F., van Kiekerk, K.L., Coquinot, Y. Jacobs, Z., Lauritzen, S.-E., Menu, M. and García-Moreno, R. (2011). A 100,000-Year-Old Ochre-Processing Workshop at Blombos Cave, South Africa. *Science*, 334 (6053), pp. 219-222.

Hermansen, B.D. and Hoffmann Jensen, C. (2011). Notes on Some Features of Possible Ritual Significance at MPPNB Shaqarat Mazyad, Southern Jordan. In Gebel, H.G.K., Hermansen, B.D. and Hoffmann Jensen, C. (Eds.), *Magic Practices and Ritual in the Near Eastern Neolithic*. Berlin: Ex Oriente, pp. 91-101.

Hermansen, B.D., Thuesen, I., Hoffmann Jensen, C., Kinzel, M., Petersen, M.B., Jørkov, M.L. and Lynnerup, N. (2006). Shkârat Msaied: The 2005 Season of Excavations. A Short Preliminary Report. *Neo-Lithics*, 1/06, pp. 3-7.

Hernanz, A., Gavira-Vallejo, J.M., Ruiz-López, J.F., Martin, S., Maroto-Valiente, Á., de Balbín-Behrmann, R., Menéndez, M. and Alcolea-González, J.J. (2011). Spectroscopy of Palaeolithic rock paintings from the Tito Bustillo and El Buxu Caves, Asturias, Spain. *Journal of Raman Spectroscopy*, 43, pp. 1644-1650.

Hernanz, A., Ruiz-López, J.F., Gavira-Vallejo, J.M., Martin, S. and Gavrilenko, E. (2010). Raman microscopy of prehistoric rock paintings from the Hoz de Vicente, Minglanilla, Cuenca, Spain. *Journal of Raman Spectroscopy*, 41, pp. 1394-1399.

Heron, C., Evershed, R.P., Chapman, B. and Pollard, A.M. (1989). Glue, disinfectant and 'chewing gum' in prehistory. In Budd, P. (Ed.), *Archaeological Sciences 1989: Proceedings of a Conference on the Application of Scientific Techniques to Archaeology, Bradford, September 1989*. Oxford: Oxbow Books, pp. 325-331.

Heron, C., Nemcek, N. and Bonfield, K.M. (1994). The Chemistry of Neolithic Beeswax. *Naturwissenschaften*, 81 (6), pp. 266-269.

Heron, C.P., Craig, O.E., Luquin, A., Steele, V.J., Thompson, A. and Piličlauskas, G. (2015). Cooking fish and drinking milk: Pottery evidence for aquatic resources and dairy products in the Southeastern Baltic from 3300-2400 Cal BC. *Journal of Archaeological Science*, 63, pp. 33-43.

Hershkovitz, I., Garfinkel, Y. and Arensburg, B. (1986). Neolithic skeletal remains at Yiftahel, Area C (Israel). *Paléorient*, 12 (1), pp. 73-81.

Hershkovitz, I., Zobar, I., Segal, I., Speirs, M.S., Meirav, O., Sherter, U., Feldman, H. and Goring-Morris, N. (1995). Remedy for an 8500 Year-old Plastered Human Skull from Kfar Hahoresh, Israel. *Journal of Archaeological Science*, 22 (6), pp. 779-788.

Hjulström, B., Isaksson, S. and Hennius, A. (2006). Organic Geochemical Evidence for Pine Tar Production in Middle Eastern Sweden During the Roman Iron Age. *Journal of Archaeological Science*, 33 (2), pp. 283-294.

Hodgskiss, T. and Wadley, L. (2017). How people used ochre at Rose Cottage Cave, South Africa: Sixty thousand years of evidence from the Middle Stone Age. *PLoS ONE*, 12 (4), e0176317. DOI: https://doi.org/10.1371/journal.pone.0176317.

Hoebe, P.W. (2014). Hunting: a matter of grave importance? A reflection on the relation between hunting related grave goods and cultural landscape in the Netherlands and surrounding areas. In Raemaekers, D.C.M. (Ed.), *Past Landscapes: Questioning Function and Meaning*. Groningen: Barkhuis Publishing, pp. 21-32.

Hoffmann, D.L., Standish, C.D., García-Diez, M., Pettitt, P.B., Milton, J.A., Zilhão, J., Alcolea-González, J.J., Cantalejo-Duarte, P., Collado, H., de Balbín, R., Lorblanchet, M, Ramos-Muñoz, J., Weniger, G.-C. and Pike, A.W.G. (2020a). U-Th dating of carbonate crusts reveals Neandertal origin of Iberian cave art. *Science*, 359 (6378), pp. 912-915.

Hoffmann, D.L., Standish, C.D., Pike, A.W.G., García-Diez, M., Pettitt, P.B., Angelucci, D.E., Villaverde, V., Zapata, J., Milton, J.A., Alcolea-González, J., Cantalejo-Duarte, P., Collado, H., de Balbín, R., Lorblanchet, M, Ramos-Muñoz, J., Weniger, G.-C. and Zilhão, J. (2020b). Dates for Neanderthal art and symbolic behaviour are reliable. *Nature Ecology & Evolution*, 2, pp. 1044-1045.

Hofmann, R., Medović, A., Furholt, M., Medović, I., Stanković Pešterac, T., Dreibrodt, S., Martini, S. and Hofmann, A. (2019). Late Neolithic multicomponent sites of the Tisza region and the emergence of centripetal settlement layouts. *Praehistorische Zeitschrift*, 94 (2), pp. 351-378.

Hole, F. (1994). Khabur Basin PPN and Early PN Industries. In Kozłowski, S.K. and Gebel, H.G.K. (Eds.), *Neolithic Chipped Stone Industries of the Fertile Crescent: Proceedings of the First Workshop on PPN Chipped Lithic Industries: Seminar für Vorderasiatische Altertumskunde, Free University of Berlin, 29th March – 2nd April, 1993*. Studies in Early Near Eastern Production, Subsistence, and Environment, 1. Berlin: Ex Oriente, pp. 331-348.

Hole, F. and Flannery, K.V. (1968). The Prehistory of Southwestern Iran: A Preliminary Report. *Proceedings of the Prehistoric Society*, 33, pp. 147-206.

Horwitz, L.K. and Goring-Morris, N. (2004). Animals and ritual during the Levantine PPNB: a case study from the site of Kfar Hahoresh, Israel. *Anthropozoologica*, 39, pp. 166-178.

Hovaneissian, M., Archier, P., Mathe, C. and Vieillescazes, C. (2006). Contribution de la chimie analytique à l'étude des exsudats végétaux styrax, storax et benjoin [Contribution of analytical chemistry to the study of plant exudates styrax, storax and benzoin]. *Comptes Rendus Chimie*, 9 (9), pp. 1192-1202.

Hull, W.Q. and Bangert, W.G. (1952). Animal Glue: A Staff-Industry Collaborative Report.... *Industrial and Engineering Chemistry*, 44 (10), pp. 2275-2284.

Hyland, D.C., Tersak, J.M., Adovasio, J.M. and Siegel, M.I. (1990). Identification of the Species of Origin of Residual Blood on Lithic Material. *American Antiquity*, 55 (1), pp. 104-112.

Ibáñez, J.J., Muñiz, J.R., Huet, T., Santana, J., Teira, L.C., Borrell, F., Rosillo, R., Iriarte, E. (2020). Flint 'figurines' from the Early Neolithic site of Kharaysin, Jordan. *Antiquity*, 94 (376), pp. 880-889.

Iršėnas, M., Rimkus, T., Butrimas, A. and Slah, G. (2018). The elks of Šventoji: Taking another closer look. *Archaeologia Baltica*, 25, pp. 125-139.

Itkis, S., Khesin, B., Eppelbaum, L. and Khalaily, H. (2003). The Natufian site of Eynan (Hula Valley, northern Israel): Magnetic prospecting reveals new features. *Israel Journal of Earth Sciences*, 52, pp. 209-219.

Ivanovaitė, L., Bjørnevad, M., Philippsen, B., Hoggard, C., Enghild, J.J., Scavenius, C., Vasiliauskaitė, A., Dručkuvienė, G., Jensen, P., Maring, R., Dodd, J., Serwatka, K., Riede, F. (2018). Making silent bones speak: The analysis of orphaned osseous tools illustrated with Mesolithic stray finds. *Archaeologia Baltica*, 25, 53-70.

Jacomet, S., Leuzinger, U. and Schibler, J. (2003). *Die jungsteinzeitliche Seeufersiedlung Arbon / Bleiche 3: Umwelt und Wirtschaft [The Neolithic Lakeside Settlement Arbon / Bleiche 3: Environment and Economy].* Archäologie im Thurgau, 12. Frauenfeld: Amtes für Archäologie des Kantons Thurgau.

János, J. and Judit, S.K. (2012). Északkelet-magyarországi és északnyugat-romániai középső neolit festett kerámiák festékanyagának azonosítása Fourier-transzformációs Infravörös Spektrofotometriai (FTIR) módszerrel [Identification of Middle Neolithic ceramics paintings from north-eastern

Hungary and north-western Romania by the means of Fourier Transformation Infrared Spectroscopy (FTIR)]. In Kreiter, A., Petŏ, À. And Tugya, B. (Eds.), *Környezet – Ember – Kultúra: A természettudományok és a régészet párbeszéde [Environment – Human – Culture: Dialogue between applied sciences and archaeology].* Budapest: Magyar Nemzeti Múzeum Nemzeti Örökségvédelmi Központ, pp. 307-316.

Jarrige, J.-F. (2006). Mehrgarh Neolithic. *Prāgdhārā*, 18, pp. 136-154.

Jayez, M. and Garazhian, O. (2013). Chipped stone industry from the excavation at the PPN settlement of Tell-e Atashi, SE Iran. In Borrell, F., Ibáñez, J.J. and Molist, M. (Eds.), *Stone Tools in Transition: From Hunter-Gatherers to Farming Societies in the Near East*. Barcelona: Universitat Autònoma de Barcelona, pp. 327-339.

Jensen, T.Z.T., Niemann, J., Iversen, K.H., Fotakis, A.K., Gopalakrishnan, S., Vågene, Å.J., Pedersen, M.W., Sinding, M.-H.S., Ellegaard, M.R., Allentoft, M.E., Lanigan, L.T., Taurozzi, A.J., Nielsen, S.H., Dee, M.W., Mortensen, M.N., Christensen, M.C., Sørensen, S.A., Collins, M.J., Gilbert, M.T.P., Sikora, M., Rasmussen, S. and Schroeder, H. (2019). A 5700 year-old human genome and oral microbiome from chewed birch pitch. *Nature Communications*, 10 (1), pp. 1-10.

Jochelson, W. (1933). *History, Ethnology and Anthropology of the Aleut*. Washington: Carnegie Institution of Washington.

Johnson, B., Waddington, C., Baker, P., Ramsey, C.B., Clogg, P., Cook, G., Cotton, J., Hamilton, D., Marshall, P. and Stern, B. (2008). Prehistoric and Dark Age Settlement Remains from Cheviot Quarry, Milfield Basin, Northumberland. *The Archaeological Journal*, 165 (1), pp. 107-264.

Jones, J., Higham, T.F.G., Chivall, D., Bianucci, R., Kay, G.L., Pallen, M.J., Oldfield, R., Ugliano, F. and Buckley, S.A. (2018). A prehistoric Egyptian mummy: Evidence for an 'embalming recipe' and the evolution of early formative funerary treatments. *Journal of Archaeological Science*, 100, pp. 191-200.

Jones, J., Higham, T.F.G., Oldfield, R., O'Connor, T.P. and Buckley, S.A. (2014). Evidence for Prehistoric Origins of Egyptian Mummification in Late Neolithic Burials. *PLoS ONE*, 9 (8), e0103608. DOI: https://doi.org/10.1371/journal.pone.0103608.

Jones, R., Towers, R., Card, N. and Odling, N. (2019). Analysis of coloured Grooved Ware sherds from the Ness of Brodgar, Orkney. *Journal of Archaeological Science: Reports*, 28, 102014.

Jongmsa, T. (1997). *Distinguishing pits from pit houses through daub analysis: The nature and location of early Neolithic Starčevo-Criş houses at Foeni-Salaş, Romania*. Unpublished: University of Manitoba. MA.

Jordanova, N., Jordanova, D., Kostadinova-Avramova, M., Lesigyarski, D., Nikolov, V., Katsarov, G. and Bacvarov, K. (2018). A Mineral Magnetic Approach to Determine Paleo-Firing Temperatures in the Neolithic Settlement Site of Mursalevo-Deveboaz (SW Bulgaria). *Journal of Geophysical Research: Solid Earth*, 123, pp. 2522-2538.

Kaal, J., Linderholm, J. and Martínez Cortizas, A. (2019). Fire, meat and totarol: organic matter in the embankments of the Neolithic site Bastuloken (North Sweden). *Analytical Pyrolysis Letters*, APL007, pp. 1-16.

Kabaciński, J., Sobkowiak-Tabaka, I., Kasztovszky, Z., Pietrzak, S., Langer, J.J., Biró, K.T. and Maróti, B. (2015). Transcarpathian influences in the Early Neolithic of Poland. A case study of Kowalewko and Rudna Wielka sites. *Acta Archaeologica Carpathica*, 50, pp. 5-32.

Kabukcu, C., Asouti, E., Pöllath, N., Peters, J. and Karul, N. (2021). Pathways to plant domestication in Southeast Anatolia based on new data from aceramic Neolithic Gusir Höyük. *Nature: Scientific Reports*, 11, 2112.

Kalafatič, H., Klindžíc, R.Š. and Šiljeg, B. (2020). Being Enclosed as a Lifestyle: Complex Neolithic Settlements of Eastern Croatia Re-Evaluated through Aerial and Magnetic Survey. *Geosciences*, 10, 384.

Kansa, S.W., Gauld, S.C., Campbell, S. and Carter, E. (2009). Whose Bones are those? Preliminary Comparative Analysis of Fragmented Human and

Animal Bones in the "Death Pit" at Domuztepe, a Late Neolithic Settlement in Southeastern Turkey. *Anthropozoologica*, 44 (1), pp. 159-172.

Karkanas, P. (2007). Identification of Lime Plaster in Prehistory Using Petrographic Methods: A Review and Reconsideration of the Data on the Basis of Experimental and Case Studies. *Geoarchaeology: An International Journal*, 22 (7), pp. 775-796.

Karkanas, P. and Efstratiou, N. (2009). Floor sequences in Neolithic Makri, Greece: micromorphology reveals cycles of renovation. *Antiquity*, 83, pp. 955-967.

Karkanas, P. and Stratouli, G. (2008). Neolithic lime plastered floors in Drakaina Cave, Kephalonia Island, Western Greece: evidence of the significance of the site. *Annual of the British School of Athens*, 103, pp. 27-41.

Kashuba, N., Kırdök, E., Damlien, H., Manninen, M.A., Nordqvist, B., Persson, P. and Götherström, A. (2019). Ancient DNA from mastic solidifies connection between material culture and genetics of mesolithic hunter-gatherers in Scandinavia. *Communications Biology*, 2 (1), pp. 1-10.

Keller, F. (1866). *The Lake Dwellings of Switzerland and Other Parts of Europe*. Translated from German by John Edward Lee. London: Longmans, Green, and Co.

Khalaily, H. and Vardi, J. (2020). The New Excavations at Motza: An Architectural Perspective on a Neolithic 'Megasite' in the Judean Hills. In Khalaily, H., Vardi, J. and Milevski, I. (Eds.), *The Mega Project at Motza (Moẓa): The Neolithic and Later Occupations up to the 20th Century: New Studies in the Archaeology of Jerusalem and Its Region*. Jerusalem: Israel Antiquities Authority, pp. 69-100.

Khalaily, H., Bar-Yosef, O., Barzilai, O., Boaretto, E., Bocquentin, F., Eirikh-Rose, A., Greenhut, Z., Goring-Morris, A., Le Dosseur, G., Marder, O., Sapir-Hen, L. and Yizhaq, M. (2007). Excavations at Motza in the Judean Hills and the early Pre-Pottery Neolithic B in the southern Levant. *Paléorient*, 33 (2), pp. 5-37.

Khalaily, H., Kuperman, T., Marom, N., Milevski, I. and Yegorov, D. (2015). Beisamun: An Early Pottery Neolithic Site in the Ḥula Basin. *ʿAtiqot*, 82, pp. 1-61.

Khalaily, H., Marder, O. and Barzilai, O. (2007). An Early Pre-Pottery Neolithic B blade cache from Motza, West of Jerusalem, Israel. In Astruc, L., Binder, D. and Briois, F. (Eds.), *Systèmes techniques et communautés du Néolithique précéramique au Proche-Orient: Actes du 5e colloque international: Fréjus, du 29 février au 5 mars 2004 [Technical Systems and Near Eastern PPN Communities: Proceedings of the 5th international Workshop: Fréjus, from February 29th to March 5th, 2004].* Antibes: APDCA, pp. 269-277.

Khalaily, H., Marder, O., Sklar-Parnes, D., Eisenberg, E., Milevski I. and Le Dosseur, G. (2005). Two Hafted Tools from Recent Excavations of PPNB Sites from the Southern Levant. *Mitekufat Haeven: Journal of the Israel Prehistoric Society*, 35, pp. 371-380.

Khalaily, H., Milevski, I. and Barzilai, O. (2013). Caching and depositing in the Pre-Pottery Neolithic B of Yiftahel, Israel. In Borrell, F., Ibáñez, J.J. and Molist, M. (Eds.), *Stone Tools in Transition: From Hunter-Gatherers to Farming Societies in the Near East*. Barcelona: Universitat Autònoma de Barcelona, pp. 219-230.

Khalaily, H., Milevski, I., Getzov, N., Hershkovitz, I., Barzilai, O., Yarosevich, A., Shlomi, V., Najjar, A., Zidan, O., Smithline, H. and Liran, R. (2008). Recent Excavations at the Neolithic Site of Yiftahel (Khalet Khalladyiah), Lower Galilee. *Neo-Lithics*, 2/08, pp. 3-11.

Kingery, W.D., Vandiver, P.B. and Noy, T. (1992). An 8,500-Year-Old Sculpted Plaster Head from Jericho (Israel). *MRS Bulletin*, 17 (1), 46-52.

Kingery, W.D., Vandiver, P.B. and Prickett, M. (1988). The Beginnings of Pyrotechnology, Part II: Production and Use of Lime and Gypsum Plaster in the Pre-Pottery Neolithic Near East. *Journal of Field Archaeology*, 15 (2), pp. 219-243.

Kirkbride, D. (1968). Beidha: Early Neolithic Village Life South of the Dead Sea. *Antiquity*, 42 (68), pp. 263-274.

Kjellström, A., Nordqvist, B., Snäll, A. and Welinder, S. (2010). Capturing the moment: chewing today and 10 000 years ago. *AmS-Skrifter*, 23, pp. 53-61.

Koller, J., Baumer, U. and Mania, D. (2001). High-tech in the Middle Palaeolithic: Neandertal-manufactured pitch identified. *European Journal of Archaeology*, 4 (3), pp. 385-397.

Kopelson, E. (1996). *Analysis and Consolidation of Architectural Plasters from Çatalhöyük, Turkey*. Unpublished: University of Pennsylvania. MA.

Kostadinova-Avramova, M., Kovacheva, M. and Jordanova, N. (2016). Early Neolithic settlement Yabalkovo (Maritsa valley, Bulgaria) in the context of archaeomagnetic studies. *Bulgarian e-Journal of Archaeology*, 6, pp. 277-294.

Kozlowski, J.K., Kaczanowska, M. and Pawlikowski, M. (1996). Chipped-Stone Industries from the Neolithic Levels at Lerna. *Hesperia: The Journal of the American School of Classical Studies at Athens*, 65 (3), pp. 295-372.

Kozłowski, S.K. (1989). Nemrik 9, a PPN Neolithic site in Northern Iraq. *Paléorient*, 15 (1), pp. 25-31.

Kozłowski, S.K. (2008). Nemrik 9. *Polish Archaeology in the Mediterranean*, 2, pp. 102-111.

Kozłowski, S.K. and Kempisty, A. (1990). Architecture of the pre-pottery neolithic settlement in Nemrik, Iraq. *World Archaeology*, 21 (3), pp. 348-362.

Kozowyk, P.R.B. and Poulis, J.A. (2019). A new experimental methodology for assessing adhesive properties shows that Neandertals used the most suitable material available. *Journal of Human Evolution*, 137, 102664. DOI: https://doi.org/10.1016/j.jhevol.2019.102664.

Kozowyk, P.R.B., Langejans, G.H.J. and Poulis, J.A. (2016). Lap Shear and Impact Testing of Ochre and Beeswax in Experimental Middle Stone Age

Compound Adhesives. *PLoS ONE*, 11 (3), e0150436. DOI: https://doi.org/10.1371/journal.pone.0150436.

Kozowyk, P.R.B., Langejans, G.H.J., Dusseldorp, G.L. and Niekus, M.J.L.Th. (2020). Reply to Schmidt et al.: Interpretation of Paleolithic adhesive production: Combining experimental and paleoenvironmental information. *PNAS*, 117 (9), pp. 4458-4459.

Kozowyk, P.R.B., Poulis, J.A. and Langejans, G.H.J. (2017). Laboratory strength testing of pine wood and birch bark adhesives: A first study of the material properties of pitch. *Journal of Archaeological Science: Reports*, 13, pp. 49-59.

Kozowyk, P.R.B., Soressi, M., Pomstra, D. and Langejans, G.H.J. (2017). Experimental methods for the Palaeolithic dry distillation of birch bark: implications for the origin and development of Neandertal adhesive technology. *Nature Scientific Reports*, 7, 8033. DOI: https://doi.org/10.1038/s41598-017-08106-7.

Kozowyk, P.R.B., van Gijn, A.L. and Langejans, G.H.J. (2020). Understanding preservation and identification biases of ancient adhesives through experimentation. *Archaeological and Anthropological Sciences*, 12, 209. DOI: https://doi.org/10.1007/s12520-020-01179-y.

Kramberger, B. (2010). Zgornje Radvanje, Cluster 10 – a Late Neolithic pit with a structure and smaller pits. *Documenta Praehistorica*, 37, pp. 311-338.

Kreiter, A., Pető, Á. and Pánczél, P. (2013). Materialising tradition: ceramic production in Early Neolithic Hungary. In Bánffy, E. (Ed.), *The Early Neolithic in the Danube-Tisza interfluve.* BAR International Series, 2013. Oxford: Archaeopress, pp. 127-140.

Kufel-Diakowska, B., Miazga, B., Łucejko, J., Ribechini, E. and Li, W. (2019). Sickles of the Funnel Beaker Culture in the light of use-wear and residue analysis. *Sprawozdania Archeologiczne*, 71, pp. 219-242.

Kuijt, I. (2002). *Life in Neolithic Farming Communities: Social Organization, Identity, and Differentiation.* New York: Kluwer Academic Publishers.

Kuijt, I. (2004). Pre-Pottery Neolithic A and Late Natufian at 'Iraq ed-Dubb, Jordan. *Journal of Field Archaeology*, 29 (3-4), pp. 291-308.

Lambuth, A. (2007). Soybean, Blood, and Casein Glues. In Tracton, A.A. (Eds.), *Coatings Materials and Surface Coatings*. Boca Raton: CRC Press, pp. 19-1-19-10.

Lanting, J.N. and Van der Plicht, J. (1995). 14C-AMS: pros and cons for archaeology. *Palaeohistoria*, 35 (36), pp. 1-12.

Larsson, L. (1996). Late Atlantic Settlement in Southern Portugal: Result of an excavation of a Mesolithic shell midden by the River Sado. C*urrent Swedish Archaeology*, 4 (1), pp. 123-139.

Larsson, L. (2007). The Loshult Arrows: Cultural Relations and Chronology. In Crombé, P., Van Strydonck, M., Sergant, J., Boudin, M. and Bats, M. (Eds.), *Chronology and Evolution within the Mesolithic of North-West Europe. Proceedings of an International Meeting, Brussels, May 30th - June 1st 2007.* Newcastle-upon-Tyne: Cambridge Scholars Publishing, pp. 131-139.

Larsson, L. and Sjöström, A. (2010). Mesolithic research in the bog Rönneholms mosse, southern Sweden. *Mesolithic Miscellany*, 21 (1), pp. 2-9.

Larsson, L. and Sjöström, A. (2011). Bog site and wetland settlement during the Mesolithic: Research from a bog in central Scania, southern Sweden. *Archäologisches Korrespondenzblatt*, 41, pp. 457-471.

Larsson, L., Sjöström, A. and Heron, C. (2016). The Rönneholm Arrow: A Find of a Wooden Arrow-tip with Microliths in the Bog Rönneholms Mosse, Central Scania, Southern Sweden. *Lund Archaeological Review*, 22, pp. 7-20.

Leroi-Gourhan, A. and Allain, J. (1979). *Lascaux Inconnu: Supplément à Gallia Préhistoire nXII [Unknown Lascaux: Supplement to Gallia Prehistory nXII].* Paris: CNRS Editions.

Leuzinger, U. (2005). Die jungneolithische Siedlung Pfyn-Breitenloo, Thurgau (Schweiz) [The Late Neolithic settlement Pfyn-Breitenloo, Thurgau Switzerland)]. In Della Casa, Ph. and Trachsel, M. (Eds.), *WES'04 – Wetland Economies and Societies. Proceedings of the International Conference in Zurich, 10-13 March 2004*. Zurich: Chronos, pp. 25-32.

Lewinsohn, T.M. (1991). The geographical distribution of plant latex. *Chemoecology*, 2, pp. 64-68.

Lisch, G.C.F. (1841). *Jahrbücher des Vereins für Mecklenburgische Geschichte und Altertumskunde, aus Arbeins des Vereins. Sechster Jahrgang [Yearbook of the Association for Mecklenburg History and Antiquities. Sixth Year]*. Schwerin: Stillerschen Hofbuchhandlung.

Lisch, G.C.F. (1872). *Jahrbücher des Vereins für Meklenburgische Geschichte und Alterthumsfunde. Siebenunddreißigster Jahrgang. [Yearbook of the Association for Mecklesnburg History and Antiquities. Thirty-Seventy Year]*. Schwerin: Stillerschen Hofbuchhandlung.

Little, A. (2014). Clonava Island revisted: a story of cooking, plants and re-occupation during the Irish Late Mesolithic. *Proceedings of the Royal Irish Academy*, 114, pp. 1-21.

Lityńska-Zajaç, M. (2016) [2007]. Early neolithic agriculture in south Poland as reconstructed from archaeobotanical plant remains. In Colledge, S. and Conolly, J. (Eds.), *The Origins and Spread of Domestic Plants in Southwest Asia and Europe*. Abingdon and New York: Routledge, pp. 315-326.

Lityńska-Zajaç, M., Moskal-Del Hoyo, M. and Nowak, M. (2008). Plant remains from an early Neolithic settlement at Moravany (eastern Slovakia). *Vegetation History and Archaeobotany*, 17, pp. 81-92.

Lombard, M. (2004). Distribution patterns of organic residues on Middle Stone Age points from Sibudu Cave, Kwazulu-Natal, South Africa. *South African Archaeological Bulletin*, 59 (180), pp. 37-44.

Lombard, M. (2005). Evidence of hunting and hafting during the Middle Stone Age at Sibidu Cave, KwaZulu-Natal, South Africa: a multianalytical approach. *Journal of Human Evolution*, 48 (3), pp. 279-300.

Lombard, M. (2006a). Direct evidence for the use of ochre in the hafting technology of Middle Stone Age tools from Sibudu Cave. *Southern African Humanities*, 18 (1), pp. 57-67.

Lombard, M. (2006b). First impressions of the functions and hafting technology of Still Bay pointed artefacts from Sibudu Cave. *Southern African Humanities*, 18 (1), pp. 27-41.

Lombard, M. (2007). The gripping nature of ochre: The association of ochre with Howiesons Poort adhesives and Later Stone Age mastics from South Africa. *Journal of Human Evolution*, 53 (4), pp. 406-419.

Lorenzo, P., González, L. and Reigosa, M.J. (2010). The genus Acacia as invader: the characteristic case of Acacia deealbata Link in Europe. *Annals of Forest Science*, 67 (1), 101. DOI: https://doi.org/10.1051/forest/2009082.

Loy, T.H. and Wood, A.R. (1989). Blood Residue Analysis at Çayönü Tepesi, Turkey. *Journal of Field Archaeology*, 16 (4), pp. 451-460.

Lübke, H., Lüth, F. and Terberger, T. (2009). Fishers or farmers? The archaeology of the Ostorf cemetery and related Neolithic find in the light of new data. *Berichte der Germanischen Kommission*, 88, pp. 307-338.

Lucquin, A., March, R.J. and Cassen, S. (2007). Analysis of adhering organic residues of two "coupes-a`-socles" from the Neolithic funerary site "La Hougue Bie" in Jersey: evidences of birch bark tar utilisation. *Journal of Archaeological Science*, 34 (5), pp. 704-710.

Luthern, M. (2012). *Using Daub, Bone, and Charcoal Samples to Establish the Chronology of Neolithic Tell Formation, and Establish Settlement Patterns, in the Körös Region, Hungary*. Unpublished: The Ohio State University. PhD.

Lyonnet, B., Guliyev, F., Bocquet, L., Bruley-Chabot, G., Samzun, A., Pecqueur, L., Jovenet, E., Baudouin, E., Fontugne, M., Raymond, P., Degorre, E., Astruc, L., Guilbeau, D., Le Dosseur, G., Benecke, N., Hamon, C., Poulmarc'h, M. and Courcier, A. (2016). Mentesh Tepe, an early settlement of the Shomu-Shulaveri Culture in Azerbaijan. *Quaternary International*, 395, pp. 170-183.

Madsen, B. and Fiedel, R. (1987). Pottery Manufacture at a Neolithic Causewayed Enclosure near Hevringholm, East Jutland. *Journal of Danish Archaeology*, 6 (1), pp. 78-86.

Madsen, T. and Jensen, H.J. (1982). Settlement and land use in early Neolithic Denmark. *Analecta Praehistorica Leidensia*, 15, pp. 63-86.

Maheri, M.R., Maheri, A., Pourfallah, S., Azarm, R. and Hadjipour, A. (2011). Improving the Durability of Straw-Reinforced Clay Plaster Cladding for Earthen Buildings. *International Journal of Architectural Heritage*, 5 (3), pp. 349-366.

Makarewicz, C. and Austin, A.E. (2006). Late PPNB Occupation at el-Hemmeh: Results from the Third Excavation Season 2006. *Neo-Lithics*, 2/06, pp. 19-22.

Makarewicz, C.A. and Goodale, N.B. (2004). Results of the Preliminary Excavations at el-Hemmeh: A Pre-Pottery Neolithic Site 5 in the Wadi el-Hasa, Jordan. *Neo-Lithics*, 2/04, pp. 5-10.

Makarewicz, C.A., Goodale, N.B., Rassmann, P., White, C., Miller, H., Haroun, J., Carlson, E., Pantos, A., Kroot, M., Kadowaki, S., Casson, A., Williams, J.T., Austin, A.E. and Fabre, B. (2006). el-Hemmeh: A multi-period Pre-Pottery Neolithic site in the Wadi el-Hasa, Jordan. *Eurasian Prehistory*, 4 (1-2), pp. 183-220.

Maloney, T.R., O'Connor, S., Wood, R., Alpin, K. and Balme, J. (2018). Carpenters Gap 1: A 47,000 year old record of indigenous adaption and innovation. *Quaternary Science Review*, 191, pp. 204-228.

Manclossi, F., Rosen, S.A. and de Miroschedji, P. (2016). The Canaanean Blades from Tel Yarmuth, Israel: A technological analysis. *Paléorient*, 42 (1), pp. 49-74.

Manhita, A., Martins, S., Costa, J., Prazeres, C., Rocha, L., Dias, C., Mirão, J. and Teixeira, D. (2014). Multi-analytical approach for the study of Neolithic pottery from the Great Dolmen of Zambujeiro (Évora, Portugal) – a preliminary study. *E-Conservation Journal*, 2, pp. 66-78.

Mania, D. and Toepfer, V. (1973). *Königsaue: Gliederung, Oekologie und Mittelpaläolithische Funde der letzten Eiszeit [Königsaue: Classification, Ecology and Middle Palaeolithic Finds of the last Ice Age]*. Berlin: Deutscher Verlag der Wissenschaften.

Marangou, C. and Stern, B. (2009). Neolithic zoomorphic vessels from Eastern Macedonia, Greece: Issues of function. *Archaeometry*, 51 (3), pp. 397-412.

Marinova, E. (2017). Archaeobotanical analysis of the Neolithic site Bâlgarčevo, Southwestern Bulgaria. In Lechterbeck, J. and Fischer, E. (Eds.), *Kontrapunkte: Festschrift für Manfred Rösch [Counterpoints: Festschrift for Manfred Rösch]*. Bonn: Habelt-Verlag, pp. 147-158.

Marschner, R.F., Duffy, L.J. and Wright, H. (1978). Asphalts from ancient town sites in Southwestern Iran. *Paléorient*, 4, pp. 97-112.

Martin, L. and Russell, N. (1996). Surface Material: Animal Bone and Worked Bone. In Hodder, I. (Ed.), *On the surface: Çatalhöyük 1993-95*. Cambridge: McDonald Institute for Archaeological Research & British Institute of Archaeology at Ankara, pp. 199-214.

Martin-Gil, F.J., Ramos-Sánchez, M.C., Martín-Gil, J., Martín-Ramos, P. and Gil-Negro, T. (2003). About an old necklace bead of presumably Canary Islands origin. *Almogaren*, 34, pp. 249-257.

Masuda, S., Goto, T., Iwasaki, T., Kamuro, H. Furusato, S., Ikeda, J., Tagaya, A., Minami, M. and Tsuneki, A. (2013) Tappeh Sang-e Chakhmaq: Investigations of a Neolithic site in Northeastern Iran. In Matthews, R. and Fazeli Nashli, H. (Eds.), *The Neolithisation of Iran: The Formation of New Societies*. Oxford: Oxbow Books, pp. 201-241.

Matlova, V., Roffet-Salque, M., Pavlu, I., Kyselka, J., Sedlarova, I., Filip, V. and Evershed, R.P. (2017). Defining pottery use and animal management at the Neolithic site of Bylany (Czech Republic). *Journal of Archaeological Science: Reports*, 14, pp. 262-274.

Matthews, R., Matthews, W., Richardson, A., Raheem, K.R., Walsh, S., Aziz, K.R., Bendrey, R., Whitlam, J., Charles, M., Bogaard, A., Iversen, I., Mudd, D. and Elliott, S. (2019). The early Neolithic of Iraqi Kurdistan: current research at Bestansur, Shahrizor Plain. *Paléorient*, 45 (2), pp. 13-32.

Mazza, P.P.A., Martini, F., Sala, B., Magi, M., Colombini, M.P., Giachi, G., Landucci, F., Lemorini, C. Modugno, F. and Ribechini, E. (2006). A new Palaeolithic discovery: tar-hafted stone tools in a European Mid-Pleistocene bone-bearing bed. *Journal of Archaeological Science*, 33 (9), pp. 1310-1318.

Mazzucco, N., Capuzzo, G., Pannocchia, C.P., Ibáñez, J.J. and Gibaja, J.F. (2018). Harvesting tools and the spread of the Neolithic into the Central-Western Mediterranean area. *Quaternary International*, 470, pp. 511-528.

McBrearty, S. and Brooks, A.S. (2000). The revolution that wasn't: a new interpretation of the origin of modern human behavior. *Journal of Human Evolution*, 39 (5), pp. 453-563.

McClure, H.A. and al-Shaikh, N.Y. (1993). Paleogeography of an ‘Ubaid archaeological site, Saudi Arabia. *Arabian Archaeology and Epigraphy*, 4, pp. 107-125.

McClure, S.B., Jochim, M.A. and Barton, M. (2006). Human Behavioral Ecology, Domestic Animals, and Land Use During the Transition to Agriculture in Valencia, Eastern Spain. In Kennett, D.J. and Winterhalder, B. (Eds.), *Behavioural Ecology and the Transition to Agriculture*. Berkeley: University of California Press, pp. 197-216.

McGovern, P.E., Glusker, D.L., Exner, L.J. and Voigt, M.M. (1996). Neolithic resinated wine. *Nature*, 381 (6582), pp. 480-481.

Médard, F. (2003). Vestiges textiles et activités de filage sur le site néolithique d'Arbon-Bleiche 3 (TG, Suisse) [Textile remains and spinning activities at the

Neolithic site of Arbon-Bleiche 3 (TG, Switzerland)]. *Bulletin de la Société Préhistorique Française*, 100 (2), pp. 375-391.

Mellaart, J. (1967). *Çatal Hüyük: A Neolithic Town in Anatolia*. London: Thames and Hudson.

Mellaart, J. (1970). *Excavations at Hacılar: Vol. 1*. Edinburgh: The British Institute of Archaeology at Ankara.

Mencke, E. (1934). Ein Microlith mit Schäftungspech aus Duvensee [A microlith with hafting pitch from Duvensee]. *Praehistorische Zeitschrift*, 25 (1), pp. 151-152.

Merpert, N.Y. and Munchaev, R.M. (1973). Early Agricultural Settlements in the Sinjar Plain, Northern Iraq. *Iraq*, 35 (2), pp. 93-113.

Merpert, N.Y. and Munchaev, R.M. (1987). The Earliest Levels at Yarim Tepe I and Yarim Tepe II in Northern Iraq. *Iraq*, 49, pp. 1-36.

Merpert, N.Y. and Munchaev, R.M. (1993). Yarim Tepe II: The Halaf Levels. In Yoffee, N. and Clark, J.J. (Eds.), *Early Stages in the Evolution of Mesopotamian Civilization: Soviet Excavations in Northern Iraq*. Tucson: University of Arizona Press, pp. 129-162.

Meyer, R.F., Attanasi, E.D. and Freeman, P.A. (2007). *Heavy Oil and Natural Bitumen Resources in Geological Basins of the World*. Reston: U.S. Department of the Interior / U.S. Geological Survey.

Micheli, R., Bassetti, M., Bernardini, F., Degasperi, N., Lughi, V., Rottoli, M., Vaccari, L. and Zanini, F. (2018). Chewing tar at the Late Neolithic pile-dwelling site of Palù di Livenza (NE Italy). In Florenzano, A., Montecchi, M.C. and Rinaldi, R. (Eds.), *Humans and environmental sustainability: Lessons from the past ecosystems of Europe and Northern Africa*. Modena / Reggio Emilia: Università degli Studi di Modena e Reggio Emilia, pp. 36-40.

Milevski, I., Khalaily, H., Getzov, N. and Hershkovitz, I. (2008). The plastered skulls and other PPNB finds from Yiftahel, Lower Galilee (Israel). *Paléorient*, 34 (2), pp. 37-46.

Miller, R. (1983). Chisel-ended Arrowheads from Tell Hadidi, Syria. *Bulletin of the Institute of Archaeology*, 20, pp. 187-190.

Mirabaud, S., Pétrequin, A.-M., Pétrequin, P. and Regert, M. (2015). Système de production des adhésifs exploités à Clairvaux VII et Clairvaux XIV [Production system of adhesives at Clairvaux VII and Clairvaux XIV]. In P. Pétrequin and A.-M. Pétrequin (Eds.), *Clairvaux et le Néolithique Moyen Bourguignon [Clairvaux and the Middle Burgundy Neolithic]*. Besançon: Presse Universitaires de Franche-Comté, pp. 1001-1021.

Mirea, P. (2011). A Neolithic microlandscape - the story of Complex 40 from Măgura-Buduiasca (Teleor 003), Teleorman County, Southern Romania. In Mills, S. and Mirea, P. (Eds.), *The Lower Danube in Prehistory: Landscape Changes and Human Environment Interactions – Proceedings of the International Conference, Alexandria, 3-5 November 2010*. Bucureşti: Renaissance, pp. 241-256.

Mirković-Marić, N. and Marić, M. (2017). Late Neolithic Tisza sites in the Serbian part of Banat. *Archaeologiai Értesítő*, 142, pp. 1-34.

Mithen, S. (2020). Lost for words: an extraordinary structure at the early Neolithic settlement of WF16. *Humanities & Social Sciences Communications*, 7 (125), pp. 1-11.

Mithen, S.J., Finlayson, B., Smith, S., Jenkins, E., Najjar, M. and Maričević, D. (2011). An 11 600 year-old communal structure from the Neolithic of southern Jordan. *Antiquity*, 85, pp. 350-364.

Mitkidou, S., Dimitrakoudi, E., Urem-Kotsoi, D., Papadopoulou, D., Kotsakis, K., Stratis, J.A., Stephanidou-Stephanatou, I. (2008). Organic residue analysis of Neolithic pottery from North Greece. *Mirochimica Acta*, 160, pp. 493-498.

Møbjerg, T. (2012). Dværgebakke I - A Mesolithic site with activity areas for children? In Stapert, D. (Ed.), *A Mind Set on Flint: Studies in Honour of Dick Stapert*. Eelde: Barkhuis, pp. 393-400.

Mökkönen, T. and Nordqvist, K. (2017). Kierikki Ware and the contemporary Neolithic asbestos- and organic-tempered potteries in North-East Europe. *Fennoscandia Archaeologica*, 34, pp. 83-116.

Molist, M., Anfruns, J., Bofill, M., Borrell, F., Clop, X., Cruells, W., Faura, J.M., Ferrer, A., Gómez, A., Guerrero, E., Saña, M., Tornero, C., Vicente, O. and Buxó, R. (2013). Tell Halula (Euphrates Valley, Syria): New data from the Late Neolithic settlement. In Nieuwenhuyse, O., Akkermans, P., Bernbeck, R. and Rogasch, J. (Eds.), *Interpreting the Late Neolithic of Upper Mesopotamia*. Turnhout: Brepols Publishers, pp. 443-453.

Monnier, G.F., Hauck, T.C., Feinberg, J.M., Luo, B., Le Tensorer, J.-M. and al Sakhel, H. (2013). A multi-analytical methodology of lithic residue analysis applied to Paleolithic tools from Hummal, Syria. *Journal of Archaeological Science*, 40 (10), pp. 3722-3739.

Moore, A.M.T. (1978). *The Neolithic of the Levant*. Unpublished: University of Oxford. PhD.

Moore, A.M.T., Hillman, G.C. and Legge, A.J. (1975). The Excavation of Tell Abu Hureyra in Syria: A preliminary report. *Proceedings of the Prehistoric Society*, 41, pp. 50-77.

Moskal-del Hoyo, M. and Lityńska-Zając, M. (2016). Plant remains from the late Neolithic settlement of Polgár-Bosnyákdomb. *Folia Quaternaria*, 84, pp. 85-98.

Mukherjee, A.J., Gibson, A.M. and Evershed, R.P. (2008). Trends in pig product processing at British Neolithic Grooved Ware sites traced through organic residues in potsherds. *Journal of Archaeological Science*, 35, pp. 2059-2073.

Munro, N.D. and Grosman, L. (2010). Early evidence (ca. 12,000 B.P.) for feasting at a burial cave in Israel. *PNAS*, 107 (35), pp. 15362-15366.

Nandris, J.G. (1988). The earliest European plaster pyrotechnology. The red floors of Lepenski Vir. *Rivista di Archeologia*, 12, pp. 14-15.

Nardella, F., Duce, C. and Ribechini, E. (2021). Analytical pyrolysis and thermal analysis to chemically characterise bitumen from Italian geological deposits and Neolithic stone tools. *Journal of Analytical and Applied Pyrolysis*, 58, 105262.

Nardella, F., Landi, N., Degano, I, Colombo, M., Serradimigni, M., Tozzi, C. and Ribechini, E. (2019). Chemical investigations of bitumen from Neolithic archaeological excavations in Italy by GC/MS combined with principal component analysis. *Analytical Methods*, 11, pp. 1449-1459.

Nativ, A., Shimelmitz, R., Agha, N., Ktalav, I. and Rosenberg, D. (2014). Hanaton: Interim Report on a Neolithic-Chalcolithic Settlement in the Lower Galilee. *Mitekufat Haeven: Journal of the Israel Prehistoric Society*, 44, pp. 117-147.

Needham, S. and Evans, J. (1987). Honey and dripping: Neolithic food residues from Runnymede Bridge. *Oxford Journal of Archaeology*, 6 (1), pp. 21-28.

Németh, G.T. (1994). Vorbericht über spätneolithische und frühkupferzeitliche Siedlungsspuren bei Lébény (Westungarn) [Preliminary report on the late Neolithic and early Copper Age settlement traces near Lébény (Western Hungary)]. *Jósa András Múzeum Évkönyve*, 36, pp 241-262.

Newman, M. and Julig, P. (1989). The identification of protein residues on lithic artifacts from a stratified boreal forest site. *Canadian Journal of Archaeology*, 13, pp. 119-132.

Nicod, P.-Y., Picavet, R., Bernard, C. and Institut F.-A. Forel de l'Université de Genève, Conseil Général de l'Isère. (2012). *Fouille archéologique de La Grande Rivoire à Sassenage (Isère) : rapport intermédiaire 2012 (opération programmée pluriannuelle 2012-2014) [Archaeological excavation of La Grande Rivoire in Sassenage (Isère): interim report 2012 (programmed multi-year operation 2012-2014]* . Geneva and Grenoble: Institut F.-A. Forel de l'Université de Genève, Conseil Général de l'Isère.

Niekus, M.J.L.Th., Kozowyk, P.R.B., Langejans, G.H.J., Ngan-Tillard, D., van Keulen, H., van der Plicht, J., Cohen, K.M., van Wingerden, W., van Os, B., Smit, B.L., Amkreutz, L.W.S.W., Kohansen, L., Verbaas, A. and Dusseldorp, G.L. (2019). Middle Paleolithic complex technology and a Neandertal tar-backed tool from the Dutch North Sea. *PNAS*, 116 (44), pp. 22081-22087.

Niesiolowska-Śreniowska, E. (1999). The early TRB 'ploughmarks' from Sarnowo in central Poland: A new interpretation. *Oxford Journal of Archaeology*, 18 (1), pp. 17-22.

Nieuwenhuyse, O.P., Bartl, K., Berghuijs, K. and Vogelsang-Eastwood, G. (2012). The cord-impressed pottery from the Late Neolithic Northern Levant: Case-study Shir (Syria). *Paléorient*, 38 (1/2), pp. 65-77.

Nieuwenhuyse, O.P., Daskiewicz, M. and Schneider, G. (2020). Investigating Late Neolithic ceramics in the northern Levant: the view from Shir. *Levant*, 52 (1-2), pp. 15-23.

Nishiaki, Y. (1995). Reexamination of Neolithic stone artifacts from Telul eth-Thalathat, northern Iraq. In Mikasa, H.I.H. Prince T. (Ed.), *Essays on Ancient Anatolia and its Surrounding Civilizations*. Wiesbaden: Harrassowitz Verlag, pp. 153-171.

Nishiaki, Y. (2007). A unique Neolithic female figurine from Tell Seker al-Aheimar, Northeast Syria. *Paléorient*, 33 (2), pp. 117-125.

Nishiaki, Y. (2018). The Late Halafian Lithic Industry of Tell Kashkashok I, the Upper Khabur, Syria. *Orient*, 53, pp. 1-21.

Nishiaki, Y., Guliyev, F., Kadowaki, S. and Omori, T. (2018). Neolithic residential patterns in the southern Caucasus: Radiocarbon analysis of rebuilding cycles of mudbrick architecture at Goytepe, west Azerbaijan. *Quaternary International*, 474, pp. 119-130.

Nishiaki, Y., Guliyev, F., Kadowaki, S., Arimatsu, Y., Hayakawa, Y., Shimogama, K., Miki, T., Akashi, C., Arai, S. and Salimbeyov, S. (2013). Hacı Elamxanlı Tepe: Excavations of the earliest Pottery Neolithic occupations on the Middle Kura, Azerbaijan, 2012. *Archäologische Mitteilungen aus Iran und Turan*, 45, pp. 1-25.

Noy, Y.T. (1989). Gilgal I: A Pre-Pottery Neolithic site, Israel. The 1985-1987 seasons. *Paléorient*, 15 (1), pp. 11-18.

Obelić, B., Krznarić Škrivanko, M., Marijan, B. and Krajcar Bronić, I. (2004). Radiocarbon dating of Sopot Culture sites (late Neolithic) in eastern Croatia. *Radiocarbon*, 46 (1), pp. 245-258.

Odriozola Lloret, C.P., Garrido Cordero, J.Á., Daura, J., Sanz, M., Martínez-Blanes, J.M. and Ángel Avilés, M. (2019). Amber imitation? Two unusual cases of Pinus resin-coated beads in Iberian Late Prehistory (3rd and 2nd millennia BC). *PLoS ONE*, 14 (5), e0215469. DOI: https://doi/org/10.1371/journal.pone.0215469.

Odriozola, C.P., Garrido-Cordero, J.A., Daura Luján, J. and Sanz, M. (2020). Resin-coated beads in Iberian Late Prehistory (3rd-2nd millennia BCE). *Materials and Manufacturing Processes*, 35 (13), pp. 1420-1423.

Oliveira, C., Bettencourt, A.M.S., Araújo, A., Gonçalves, L., Kuźniarska-Biernacka, I. and Costa, A.L. (2017). Integrated analytical techniques for the study of colouring materials from two Megalithic barrows. *Archaeometry*, 59 (6), pp. 1065-1081.

Olszewski, D.I. (1994). The PPN Glossed Blades from 'Ain Ghazal, Jordan (1982-85 and 1988-89 seasons). In H.G. Gebel and S.K. Kozłowski (Eds.), *Neolithic Chipped Stone Industries of the Fertile Crescent: Proceedings of the First Workshop on PPN Chipped Lithic Industries*. Studies in Early Near Eastern Production, Subsistence, and Environment, 3. Berlin: Ex Oriente, pp. 467-478.

Onfray, M. (2020). La question de l'utilisation du torchis dans l'aménagement des enceintes néolithiques du Centre-Ouest de la France : exemples comparés des enceintes de Champ-Durand à Nieuil-sur-l'Autise (Vendée) et de Bellevue à Chenommet (Charente) [The question of the use of cob in the construction of Neolithic enclosures in central-western France: comparative examples of the enclosures of Champ-Durand in Nieuil-sur-l'Autise (Vendée) and

Bellevue in Chenommet (Charente)]. In Joussaume, R., Large, J.-M., Corson, S., Le Meur, N. and Tortuyaux, J.-P. (Eds.), *Enceintes néolithiques de l'Ouest de la France de la Seine à la Gironde [Neolithic enclosures in western France from the Seine to the Gironde]*. Les Lucs-sur Boulogne: Colloque CrabeNéo, pp. 321-334.

Oras, E., Lucquin, A., Lõugas, L., Tõrv, M., Kriiska, A. and Craig, O.E. (2017). The adoption of pottery by north-east European hunter-gatherers: Evidence from lipid residue analysis. *Journal of Archaeological Science*, 78, pp. 112-119.

Orengo, H.A., Palet, J.M., Ejarque, A., Miras, Y. and Riera, S. (2013). Pitch production during the Roman period: an intensive mountain industry for a globalised economy? *Antiquity*, 87, pp. 807-814.

Orschiedt, J. (2018). The Late Upper Palaeolithic and earliest Mesolithic evidence of burials in Europe. *Philosophical Transactions of the Royal Society B*, 373, 20170264. DOI: http://dx.doi.org/10.1098/rstb.2017.0264.

Osipowicz, G. (2005). A Method of Wood Tar Production, Without the Use of Ceramics. *euroREA*, 2/2005, pp. 11-17.

Osipowicz, G., Orłowska, J., Piličiauskienė, G. and Piličiauskas, G. (2020). Frontlets from the south-east coast of the Baltic Sea? Seal craniums from Šventoji: A unique clue to understanding the symbolic culture of European middle Holocene hunter-gatherers. *Journal of Archaeological Science: Reports*, 34, 102638.

Ospitali, F., Smith, D.C. and Lorblanchet, M. (2006). Preliminary investigations by Raman microscopy of prehistoric pigments in the wall-painted cave at Roucadour, Quercy, France. *Journal of Raman Spectroscopy*, 37, pp. 1063-1071.

Ottaway, B.S. (1992). The Fischergasse: a wetland site in Lower Bavaria. *Antiquity*, 66, pp. 649-701.

Oudemans, T.F.M., Limmer, B., Kubiak-Martens, L. and Kooistra, L.I. (2019). Cooking in Pestenacker – Evidence from organic residues in vessels from one household in a Late Neolithic wetland settlement in Bavaria (3496-3410 BC). *Archäologisches Korrespondenzblatt*, 49, pp. 19-40.

Oxilia, G., Peresani, M., Romandini, M., Matteucci, C., Spiteri, C.D., Henry, A.G., Schulz, D., Archer, W., Crezzini, J., Boschin, F., Boscato, P., Jaouen, K., Dogandzic, T., Broglio, A., Moggi-Cecchi, J., Fiorenza, L., Hublin, J.-J., Kullmer, O. and Benazzi, S. (2015). Earliest evidence of dental caries manipulation in the Late Upper Palaeolithic. *Nature Scientific Reports*, 5, 12150. DOI: https://doi.org/10.1038/srep12150.

Özdoğan, M. and Dede, Y. (1998). An Anthropomorphic Vessel from Toptepe – Eastern Thrace. In Stefanovich, M., Todorova, H. and Hauptmann, H. (Eds.), *In the Steps of James Harvey Gaul, Vol. 1: James Harvey Gaul in Memoriam*. Sofia: The James Harvey Gaul Foundation, pp. 143-152.

Özkaya, V. (2009). Excavations at Körtik Tepe. A New Pre-Pottery Neolithic A Site in Southeastern Anatolia. *Neo-Lithics*, 2/09, pp. 3-8.

Paliukaitė, M., Vaitkus, A. and Zofka, A. (2014). Evaluation of bitumen fractional composition depending on the crude oil type and production technology. In Cygas, D. and Tollazzi, T. (Eds.), *Environmental Engineering 9th ICEE: Selected Papers*, enviro.2014.162. Vilnius: Vilnius Gediminas Technical University. DOI: http://dx.doi.org/10.3846/enviro.2014.162.

Palomo, A., Gibaja, J.F., Piqué, R., Bosch, A., Chinchilla, J. and Tarrús, J. (2011). Harvesting cereals and other plants in Neolithic Iberia: the assemblage from the lake settlement at La Draga. *Antiquity*, 85 (329), pp. 759-771.

Papakosta, V. and Pesonen, P. (2019). Lipid residues in early hunter-gatherer ceramics from Finland. In: Mannermaa, K., Manninen, M. A., Pesonen, P., Seppänen, L. (Eds.), *Helsinki Harvest: Proceedings of the 11th Nordic Conference on the Application of Scientific Methods in Archaeology*. Helsinki: Archaeological Society of Finland, pp. 32-47.

Parker Pearson, M., Pollard, J., Richards, C., Thomas, J., Welham, K., Albarella, U., Chan, B., Marshall, P. and Viner, S. (2011). Feeding Stonehenge: Feasting in Late Neolithic Britain. In Aranda Jiménez, G., Montón-Subías, S.

and Sánchez Romero, M. (Eds.), *Guess Who's Coming to Dinner: Feasting Rituals in the Prehistoric Societies of Europe and the Near East*. Oxford: Oxbow Books, pp. 73-90.

Parkinson, W.A., Gyucha, A. and Yerkes, R.W. (2002). The Neolithic-Copper Age transition on the Great Hungarian Plain: recent excavations at the Tiszapolgár Culture settlement of Vésztő-Bikeri. *Antiquity*, 76, pp. 619-620.

Pawlik, A. and Thissen, J. (2017). Traceological analysis of "unusual" wear traces on lithic artefacts from the Middle Palaeolithic site Inden-Altdorf and the functional context of the site. *Quaternary International*, 427 (B), pp. 104-127.

Pawlik, A.F. (2004). Identification of hafting traces and residues by scanning electron microscopy and energy-dispersive analysis of X-rays. In Walker, E.A., Wenban-Smith, F. and Healy, F. (Eds.), *Lithics in Action: Papers from the conference Lithic Studies in the Year 2000*. Oxford: Oxbow Books, pp. 169-179.

Pawlik, A.F. (2010). Have we overlooked something? Hafting traces and indications of modern traits in the Philippine Palaeolithic. *Bulletin of the Indo-Pacific Prehistory Association*, 30, pp. 35-53.

Pawlik, A.F. (2012). Behavioural Complexity and Modern Traits in the Philippine Upper Palaeolithic. *Asian Perspectives*, 51 (1), pp. 22-46.

Pawlik, A.F. and Thissen, J.P. (2011a). Hafted armatures and multi-component tool design at the Micoquian site of Inden-Altdorf, Germany. *Journal of Archaeological Science*, 38 (7), pp. 1699-1708.

Pawlik, A.F. and Thissen, J.P. (2011b). The 'Palaeolithic Prospection in the Inde Valley' Project. E*&G Quaternary Science Journal*, 60 (1), pp. 66-77.

Pedersen, C.H. (1994). Late Neolithic-Chalcolithic Chipped Stone from Tell Mashnaqa, Northern Syria. In Kozłowski, S.K. and Gebel, H.G.K. (Eds.), *Neolithic Chipped Stone Industries of the Fertile Crescent: Proceedings of the First Workshop on PPN Chipped Lithic Industries: Seminar für Vorderasiatische Altertumskunde, Free University of Berlin, 29th March –*

2nd April, 1993. Studies in Early Near Eastern Production, Subsistence, and Environment, 1. Berlin: Ex Oriente, pp. 383-386.

Pelisiak, A. (2015). Interpreting the Funnel Beaker Culture village in Central Poland: Intra-site organisation and the community. In Diachenko, A., Menotti, F., Ryzhov, S., Bunyatyan, K. and Kadrow, S. (Eds.), *The Cucuteni-Trypillia Cultural Complex and its Neighbours: Essays in Memory of Volodymyr Kruts*. Lviv: Astrolabe, pp. 241-255.

Penn Museum. (2020). *Wine Jar: Images for Object 69-12-15*. [Online]. Available at https://www.penn.museum/collections/object_images.php?irn=72388 [Accessed 14/10/2021].

Pennetta, A., Fico, D., Eramo, G., Muntoni, I.M., De Benedetto, G.E. (2020). Extending the inter-Adriatic trade of bitumen beyond the fifth millennium BCE. *Organic Geochemistry*, 142, 104013. DOI: https://doi.org/10.1016/j.orggeochem.2020.104013.

Peros, M. (2000). Sickle Blade Design and Hafting Strategies at Tabaqat al-Buma, a Late Neolithic Farmstead in Wadi Ziqlab, Northern Jordan. *Neo-Lithics*, 2-3/00, 2-4.

Perthuison, J., Schaeffer, P., Debels, P., Galant, P. and Adam, P. (2020). Betulin-related esters from birch bark tar: Identification, origin and archaeological significance. *Organic Geochemistry*, 139 (103944), pp. 1-12.

Pesonen, P. (1996). Archaeology of the Jaamankangas area – with special reference to the Rääkkylä Pörrinmökki Stone Age settlement site. In Kirkinen, T. (Ed.), *Environmental Studies in Eastern Finland: Reports of the Ancient Lake Saimaa Project*. Helsinki Papers in Archaeology, 8. Helsinki: University of Helsinki, pp. 93-117.

Pesonen, P. (1999). Radiocarbon Dating of Birch Bark Pitches in Typical Comb Ware in Finland. In Carpelan, C. and Huurre, M. (Eds.), *Dig it All: Papers Dedicated to Ari Siiriäinen*. Helsinki: The Finnish Antiquarian Society and The Archaeological Society of Finland, pp. 191-197.

Pesonen, P. (2013). Stratigraphy and chronology of a Stone Age pithouse in Raahe, northern Ostrobothnia. In K. Johanson and M. Torv (Eds), *Man, His Time, Artefacts, and Places: Collection of Articles Dedicated to Richard Indreko = Inimene, tema aeg, esemed ja paigad: Richard Indrekole pühendatud ar-tiklite kogumik*. Tallinn: Muinasaja Teadus, pp. 517-545.

Pesonen, P., Oinonen, M., Carpelan, C. and Onkamo, P. (2012). Early Subneolithic ceramic sequences in eastern Fennoscandia – a Bayesian approach. *Radiocarbon*, 54 (3-4), pp. 661-676.

Petersen, P.V. (2021). Zigzag lines and other protective patterns in Palaeolithic and Mesolithic art. *Quaternary International*, 573, pp. 66-74.

Pettitt, P.B. (2002). The Neanderthal dead: exploring mortuary variability in Middle Palaeolithic Eurasia. *Before Farming*, 1 (2), pp. 1-19.

Petukhova, T. (2000). A history of fish glue as an artist's material: Applications in paper and parchment artifacts. *The Book and Paper Group Annual*, 19, pp. 111-114.

Philokyprou, M. (2012). The Beginnings of Pyrotechnology in Cyprus. *International Journal of Architectural Heritage*, 6 (2), pp. 172-199.

Philokyprou, M. (2021). Earth-Based Building Materials. The First Use of Clay Mortars and Adobes in Antiquity in Cyprus. *International Journal of Architectural Heritage*, 15, pp. 1-18.

Pichon, F. (2017). Exploitation of the cereals during the Pre-pottery Neolithic of Dja'de-el-Mughara: Preliminary results of the functional study of the glossy blades. *Quaternary International*, 427, pp. 138-151.

Pietrzak, S. (2019). Fragmenty naczyń ze śladami materiałów organicznych oraz smolistych substancji zbrylonych [Fragments of vessels with traces of organic material and tarry substances]. In Pyżewicz, K. (Ed.), *Żuławka 13, gm. Wyrzysk - pozostałości wielofazowego osadnictwa z epoki kamienia na terenie Wielkopolski [Żuławka 13, commune Wyrzysk – remains of a multi-phase settlement from the Stone Age in Greater Poland]*. Poznań: Poznańskie Towarzystwo Przyjaciół Nauk, pp. 205-226.

Pike-Tay, A., Bartosiewicz, L., Gál, E. and Whittle, A. (2004). Body Part Representation and Seasonality: Sheep/Goat, Bird and Fish Remains From Early Neolithic Ecsegfalva 23, SE Hungary. *Journal of Taphonomy*, 2 (4), pp. 221-246.

Pizzi, A. and Mittal, K.L. (2003). *Handbook of Adhesive Technology: Second Edition, Revised and Expanded*. Boca Raton: CRC Press.

Poduska, K.M., Regev, L., Berna, F., Mintz, E., Milevski, I., Khalaily, H., Weiner, S. and Boaretto, E. (2012). Plaster characterization at the PPNB site of Yiftahel (Israel) including the use of 14C: Implications for plaster production, preservation, and dating. *Radiocarbon*, 54 (3-4), pp. 887-896.

Popova, Ts. (2014). Plant husbandry of Early Neolithic Yabalkovo. In Roodenberg, J., Leshtakov, K. and Petrova, V. (Eds.), *Yabalkovo: volume 1*. Sofia: ATE - Ars et Technica Explicatus, pp. 415-424.

Porčič, M. (2012). De facto refuse or structured deposition? House inventories of the late Neolithic Vinča Culture. *Starinar*, 62, pp. 19-43.

Portillo, M., Albert, R.M., Kadowaki, S. and Nishiaki, Y. (2010). Domestic activities at Early Neolithic Tell Seker al-Aheimar (Upper Khabur, Northeastern Syria) through phytoliths and spherulites studies. In Delhon, C., Théry-Parisot, I. and Thiébault, S. (Eds.), *Des Hommes et des Plantes. Exploitation du milieu et gestion des ressources végétales de la préhistoire à nos jours. XXXe rencontres internationales d'archéologie et d'histoire d'Antibes [Of Men and Plants. Exploitation of the environment and management of plant resources from prehistory to the present day. XXXth international meeting of archaeology and history of Antibes]*. Antibes: Éditions APDCA, pp. 19-30.

Portillo, M., Kadowaki, S., Nishiaki, Y. and Albert, R.M. (2014). Early Neolithic household behavior at Tell Seker al-Aheimar (Upper Khabur, Syria): a comparison to ethnoarchaeological study of phytoliths and dung spherulites. *Journal of Archaeological Science*, 42, pp. 107-118.

Prinsloo, L.C., Tournié, A., Colomban, P., Paris, C. and Bassett, S.T. (2013). In search of the optimum Raman/IR signatures of potential ingredients used in San/Bushman rock art paint. *Journal of Archaeological Science*, 40 (7), pp. 2981-2990.

Prokeš, L., Procházková, M., Kuča, M., Parma, D., Fojtík, P. and Humpola, D. (2009-2010). Identifikace tmavých smolných hmot z neolitických nálezů na Moravě [Identification of dark tar masses from Neolithic finds in Moravia]. *Sborník prací Filozofické fakulty brněnské univerzity M*, 14–15, pp. 113–130.

Quero, T., Martinelli, M.C. and Giordano, L. (2019). The Neolithic Site of San Martino – Sicily: Working and Circulation of Obsidian from Lipari. *Open Archaeology*, 5, pp. 65-82.

Raczky, P., Anders, A., Sebők, K., Csippán, P. and Tóth, Z. (2015). The Times of Polgár-Csőszhalom: Chronologies of Human Activities in a Late Neolithic Settlement in Northeastern Hungary. In Hansen, S., Raczky, P., Anders, A. and Reingruber, A. (Eds.), *Neolithic and Copper Age between the Carpathians and the Aegean Sea: Chronologies and Technologies from the 6th to the 4th Millennium BCE: International Workshop Budapest 2012*. Archäologie in Eurasien, 31. Bonn: Habelt-Verlag, pp. 21-48.

Raemaekers, D.C.M., Kubiak-Martens, L. and Oudemans, T.F.M. (2013). New food in old pots – charred organic residues in Early Neolithic ceramic vessels from Swifterbant, The Netherlands (4300-4000 CAL BC). *Archäologisches Korrespondenzblatt*, 43, pp. 315-333.

Rageot, M., Lepère, C., Henry, A., Binder, D., Davtian, G., Filippi, J.J., Fernandez, X., Guilaine, J., Jallet, F., Radi, G. and Thirault, E. (2021). Management systems of adhesive materials throughout the Neolithic in the North-West Mediterranean. *Journal of Archaeological Science*, 126, 105309. DOI: https://doi.org/10.1016/j.jas.2020.105309.

Rageot, M., Pêche-Quilichini, K., Py, V., Filippi, J.-J., Fernandez, X. and Regert, M. (2016). Exploitation of beehive products, plant exudates and tars in Corsica during the early Iron Age. *Archaeometry*, 58 (2), pp. 315-332.

Rageot, M., Théry-Parisot, I., Beyries, S., Lepère, C., Carré, A., Mazuy, A., Filippi, J.-J., Fernandez, X., Binder, D. and Regert, M. (2019). Birch Bark Tar Production: Experimental and Biomolecular Approaches to the Study of a

Common and Widely Used Prehistoric Adhesive. *Journal of Archaeological Method and Theory*, 26, pp. 276-312.

Rampazzi, L., Campo, L., Cariati, F., Tanda, G. and Colombini, M.P. (2007). Prehistoric wall paintings: The case of the Domus de Janas necropolis (Sardinia, Italy). *Archaeometry*, 49 (3), pp. 559-569.

Ray, K. and Thomas, J. (2020). Houses Foundational: Gathering Histories at Dorstone Hill, Herefordshire. In Barclay, A., Field, D. and Leary, J. (Eds.), *Houses of the Dead?* Oxford: Oxbow Books, pp. 108-119.

Rees, A.R., Dunwell, A., Johnson, M., Miller, J. and Ramsay, S. (2004). The excavation of prehistoric and medieval features at Inchture, Perth and Kinross. *Tayside and Fife Archaeological Journal*, 10, pp. 84-93.

Regert, M. (2004). Investigating the history of prehistoric glues by gas chromatography – mass spectrometry. *Journal of Separation Science*, 27 (3), pp. 244-254.

Regert, M., Dudd, S.N., van Bergen, P.F., Pétrequin, P. and Evershed, R.P. (2001). Investigations of solvent extractable lipids and insoluble polymeric components: organic residues in Neolithic ceramic vessels from Chalain (Jura, France). *British Archaeological Reports*, S939, pp. 78-90.

Regnell, M., Gaillard, M.-J., Bertholin, T.S. and Karsten, P. (1995). Reconstruction of environment and history of plant use during the late Mesolithic (Ertebølle culture) at the inland settlement of Bökeberg III, southern Sweden. *Vegetation History and Archaeobotany*, 4 (2), pp. 67-91.

Rehhoff, L., Akkermans, P., Leonardsen, E. and Thuesen, I. (1990). Plasters: Gypsum or calcite? A preliminary case study of Syrian plasters. *Paléorient*, 16 (2), pp. 79-87.

Reingruber, A. (2005). The Argissa Magoula and the Beginning of the Neolithic in Thessaly. In Lichter, C. and Meriç, R. (Eds.), *How Did Farming Reach Europe?: Anatolian-European Relations from the Second Half of the 7th Through the First Half of the 6th Millennium Cal BC.* Istanbul: Ege Yayınları, pp. 155-171.

Reitmaier, T. (2012). *Letzte Jäger, erste Hirten: Hochalpine Archäologie in der Silvretta [Last Hunters, First Shepherds: High Alpine Archaeology in the Silvretta].* Chur: Archäologischer Dienst Graubünden.

Řídký, J., Končelová, M., Šumberová, R., Limburský, P. and Květina, P. (2014). How Were Neolithic Ditches Filled In? Deposition Study of Two Enclosures from Bohemia. *European Journal of Archaeology*, 17 (4), pp. 579-601.

Ridout-Sharpe, J. (2015). Changing lifestyles in the northern Levant: Late Epipalaeolithic and early Neolithic shells from Tell Abu Hureyra. *Quaternary International*, 390, pp. 102-116.

Riel-Salvatore, J., Lythe, A. and Uribe Albornoz, A. (2021). New insights into the spatial organization, stratigraphy and human occupations of the Aceramic Neolithic at Ganj Dareh, Iran. *PLoS ONE*, 16 (8), e0251318. DOI: https://doi.org/10.1371/journal.pone.025131.

Riley, D.N. (1957). Neolithic and Bronze Age Pottery from Risby Warren and other Occupation Sites in North Lincolnshire. *Proceedings of the Prehistoric Society*, 23, pp. 40-56.

Rimkus, T. (2018). Kongemose flint technology in the East Baltic area. Some examples from Lithuanian Stone Age sites. *Archaeologia Baltica*, 25, pp. 71-81.

Ritter, J. (2013). *B3a km 19 - Ein linienbandkeramischer Fundplatz bei Friedberg, Wetteraukreis [B3a km 19 – A Linear Pottery site near Friedberg, Wetteraukreis].* Unpublished: Mainz: Johannes Gutenberg-Universität Mainz. MA.

Roberts, A., Barton, N. and Evans, J. (1998). Early Mesolithic Mastic: Radiocarbon Dating and Analysis of Organic Residues from Thatcham III, Star Carr and Lackford Heath. In Ashton, N., Healy, F. and Pettitt, P. (Eds.), *Stone Age Archaeology: Essays in Honour of John Wymer*. Oxbow Monograph 102, Lithic Studies Society Occasional Paper 6. Oxford: Oxbow Books, pp. 185-192.

Robson, H.K., Saul, H., Steele, V.J., Meadows, J., Nielsen, P.O., Fischer, A., Heron, C.P. and Craig, O.E. (2021). Organic residue analysis of Early Neolithic 'bog pots' from Denmark demonstrates the processing of wild and domestic foodstuffs. *Journal of Archaeological Science: Reports*, 36, 102829.

Robson, H.K., Skipitytė, R., Piličiauskienė, G., Lucquin, A., Heron, C., Craig, O.E. and Piličiauskas, G. (2019). Diet, cuisine and consumption practices of the first farmers in the southeastern Baltic. *Archaeological and Anthropological Sciences*, 11, pp. 4011-4024.

Robson, J.K., Saul, H., Steele, V.J., Meadows, J., Nielsen, P.O., Fischer, A., Heron, C.P. and Craig, O.E. (2021). Organic residue analysis of Early Neolithic 'bog pots' from Denmark demonstrates the processing of wild and domestic foodstuffs. *Journal of Archaeological Science: Reports*, 36, 102829.

Rodríguez-Vidal, J., d'Errico, F., Pacheco, F.G, Blasco, R., Rosell, J., Jennings, R.P., Queffelec, A., Finlayson, G., Fa, D.A., Gutiérrez López, J.M., Carrión, J.S., Negro, J.J., Finlayson, S., Cáceres, L.M., Bernal, M.A., Jiménez, S.F. and Finlayson, C. (2014). A rock engraving made by Neanderthals in Gibraltar. *PNAS*, 111 (37), pp. 13301-13306.

Roffet-Salque, M., Regert, M., Evershed, R.P., Outram, A.K., Cramp, L.J.E., Decavallas, O., Dunne, J., Gerbault, P., Mileto, S., Mirabaud, S., Pääkkönen, M., Smyth, J., Šoberl, L., Whelton, J.L., Alday-Ruiz, A., Asplund, H., Bartkowiak, M., Bayer-Niemeier, E., Belhouchet, L., Bernardini, F., Budja, M., Cooney, G., Cubas, M., Danaher, E.M., Diniz, M., Domboróczki, L., Fabbri, C., González-Urquijo, J.E., Guilaine, J., Hachi, S., Hartwell, B.N., Hofmann, D., Hohle, I., Ibáñez, J.J., Karul, N., Kherbouhe, F., Kiely, J., Kotsakis, K., Lueth, F., Mallory, J.P., Manen, C., Marciniak, A., Maurice-Chabard, B., McGonigle, M.A., Mulazzani, S., Özdoğan, M., Perić, O.S., Perić, S.R., Petrasch, K., Pétrequin, A.-M., Pétrequin, P., Poensgen, U., Pollard, C.J., Poplin, F., Radi, G., Stadler, P., Stäuble, H., Tasić, N., Urem-Kotsou, D., Vuković, J.B., Walsh, F., Whittle, A., Wolfram, S., Zapata-Peña, L., Zoughlami, J. (2015). Widespread exploitation of the honeybee by early Neolithic farmers. *Nature*, 527, pp. 226-231.

Roldán García, C., Villaverde, V., Marín, I.R. and Mascarós, S.M. (2016). A Unique Collection of Palaeolithic Painted Portable Art: Characterization of Red and Yellow Pigments from the Parpalló Cave (Spain). *PLoS ONE*, 11 (10), e0163565. DOI: https://doi.org/10.1371/journal.pone.0163565.

Rollefson, G., Schmandt-Besserat, D. and Rose, J.C. (1999). A decorated skull from MPPNB ʻAin Ghazal. *Paléorient*, 24 (2), pp. 99-104.

Rollefson, G.O. (1983). Ritual and Ceremony at Neolithic Ain Ghazal (Jordan). *Paléorient*, 9 (2), pp. 29-38.

Rollefson, G.O. (1986). Neolithic ʻAin Ghazal (Jordan): Ritual and Ceremony, II. *Paléorient*, 12 (1), pp. 45-52.

Rollefson, G.O. (1990). The Uses of Plaster at Neolithic ʻAin Ghazal, Jordan. *Archaeomaterials*, 4, pp. 33-54.

Rollefson, G.O. (2000). Ritual and Social Structure at Neolithic ʻAin Ghazal. In Kuijt, I. (Ed.), *Life in Neolithic Farming Communities: Social Organization, Identity and Differentiation*. New York: Kluwer Academic / Plenum Publishers, pp. 165-190.

Rollefson, G.O. and Simmons, A.H. (1985). The Early Neolithic Village of 'Ain Ghazāl, Jordan: Preliminary Report on the 1983 Season. *Bulletin of the American Schools of Oriental Research: Supplementary Studies*, 23, pp. 35-52.

Rollefson, G.O. and Simmons, A.H. (1986). The Neolithic Village of 'Ain Ghazāl, Jordan: Preliminary Report on the 1984 Season. *Bulletin of the American Schools of Oriental Research: Supplementary Studies*, 24, pp. 145-164.

Rollefson, G.O. and Simmons, A.H. (1988). The Neolithic Village of 'Ain Ghazāl, Jordan: Preliminary Report on the 1985 Season. *Bulletin of the American Schools of Oriental Research: Supplementary Studies*, 25, pp. 93-106.

Rollefson, G.O., Grissom, C.A. and Griffin, P.S. (1998). Three late eighth millennium plastered faces from 'Ain Ghazal, Jordan. *Paléorient*, 24 (1), pp. 59-70.

Rollefson, G.O., Kafafi, Z. and Simmons, A.H. (1989). Burial practices at the Neolithic Village of ‘Ain Ghazal (Jordan). *Bulletin Trimestriel - Société d'Anthropologie du Sud-Ouest*, 24 (2), pp. 115-122.

Rollefson, G.O., Kafafi, Z.A. and Simmons, A.H. (1991). The Neolithic Village of 'Ain Gh̊azal, Jordan: Preliminary Report on the 1988 Season. *Bulletin of the American Schools of Oriental Research: Supplementary Studies*, 27, pp. 95-116.

Rollefson, G.O., Rowan, Y. and Wasse, A. (2014). Neolithic Settlement at Wisad Pools, Black Desert. *Neo-Lithics*, 1/13, pp. 11-23.

Rollefson, G.O., Rowan, Y., Wasse, A., Hill, A.C., Kersel, M., Lorentzen, B., al-Basaireh, K. and Ramsay, J. (2016). Investigations of a Late Neolithic Structure at Mesa 7, Wadi al-Qattafi, Black Desert, 2015. *Neo-Lithics*, 1/16, pp. 3-12.

Rollefson, G.O., Simmons, A.H. and Kafafi, Z. (1992). Neolithic Cultures at 'Ain Ghazal, Jordan. *Journal of Field Archaeology*, 19 (4), pp. 443-470.

Ronen, A., Bentur, A. and Soroka, I. (1991). A plastered floor from the Neolithic village, Yiftahel (Israel). *Paléorient*, 17 (2), pp. 149-155.

Roodenberg, J.J. (1983). Traces d’utilisation sur les haches polies de Bouqras (Syrie). In Cauvin, M.-C. (ed.), *Traces d'utilisation sur les outils néolithiques du Proche Orient: Table ronde CNRS tenue à Lyon du 8 au 10 juin 1982 [Traces of use on Neolithic tools from the Near East: CNRS round table held in Lyon from June 8 to 10, 1982].* Travaux de la Maison de l’Orient, 5. Lyon: Maison de l’Orient et de la Méditerranée Jean Pouilloux, pp. 177-185.

Rosanó, P. and Pellizzaro, S. (2005). Analisi chimico-stratigrafico di tre pietre dipinte con ocra [Chemical-stratigraphic analysis of three stones painted with ochre]. In Broglio, A. and Dalmeri, G. (Eds.), *Pitture paleolitiche nelle Prealpi Venete: Grotta di Fumane e Riparo Dalmeri [Palaeolithic paintings in the*

Venetian Pre-Alps: Fumane Cave and Riparo Dalmeri]. Verona: Cierre Edizioni, pp. 139-143.

Ross, J.H. (1981). An analysis of the African Acacia species: their distribution, possible origins and relationships. *Bothalia*, 13 (3/4), pp. 389-413.

Rosso, D.E., d'Errico, F. and Queffelec, A. (2017). Patterns of change and continuity in ochre use during the late Middle Stone Age of the Horn of Africa: The Porc-Epic Cave record. *PLoS ONE*, 12 (5), e0177298. DOI: https://doi.org/10.1371/journal.pone.0177298.

Rots, V., Van Peer, P. and Vermeersch, P.M. (2011). Aspects of tool production, use, and hafting in Palaeolithic assemblages from Northeast Africa. *Journal of Human Evolution*, 60 (5), pp. 637-664.

Roustaei, K., Mashkour, M. and Tengberg, M. (2015). Tappeh Sang-e Chakmaq and the beginning of the Neolithic in north-east Iran. *Antiquity*, 89 (345), pp. 573-595.

Rück, O. (2001). Zwei Grundrisse aus der brandkeramischen Siedlung Wittislingen "Am Wiesenberg", Lkr. Dillingen, Bayerisch-Schwaben [Two floor plans from the Bandkeramik settlement "Am Wiesenberg", Wittislingen, district of Dillingen, Bavarian Swabia]. *Archäologische Informationen*, 24 (1), pp. 141-154.

Ruiz, J.F., Hernanz, A., Armitage, R.A., Rowe, M.W., Viñas, R., Gavria-Vallejo, J.M. and Rubio, A. (2012). Calcium oxalate AMS 14C dating and chronology of post-Palaeolithic rock paintings in the Iberian Peninsula. Two dates from Abrigo de los Oculados (Henarejos, Cuenca, Spain). *Journal of Archaeological Science*, 39 (8), pp. 2655-2667.

Rumiński, J.K. and Osipowicz, G. (2014). Neolithic adhesive from a t-shaped ornamental element excavated at Site 14 at Kowal, Kuyavia, Central Poland. *Archaeometry*, 56 (1), pp. 129-144.

Sah, V.A. (2019). O primenenii smolistykh veshchestv v praktikakh rannego Neolita v lesostepnom priishim'ye [On the use of resinous substances in the

Early Neolithic of the forest-steppe Ishimye]. *Vestnik Arkheologii, Antropologii I Etnografii*, 4 (47), pp. 5-14.

Saile, T., Sedlmaier, H. and Dębiec, M. (2018). Šárka in Wolhynien und in Bayern Ein Beitrag zu spätbandkeramischen Dreiecksintarsien [Šárka in Volhynia and in Bavaria: A contribution to late Linear Pottery Triangular Intarsia]. *Archäologisches Korrespondenzblatt*, 48, pp. 27-38.

Sałacińska, B., Sałaciński, S. and Chojnowska, I. (2018). *Wyniki badań ratowniczych osady Kultury Pucharów Lejkowatych w Kownacicy, pow. Garwoliński [The results of the rescue excavation at the settlement of the Funnel Beaker Culture at Kownacica, Garwolin County].* Wiadomości Archeologiczne, 69. Montpellier: Editions de L'Espérou, pp. 79-119.

Salisbury, R.B. and Morris, M.R. (2009). Social and Settlement Dynamics in the Hungarian Late Neolithic and Early Copper Age – A Regional Inquiry. In Thurston, T.L. and Salisbury, R.B. (Eds.), *Reimagining Regional Analyses: The Archaeology of Spatial and Social Dynamics*. Newcastle upon Tyne: Cambridge Scholars Publishing, pp. 130-163.

Salisbury, R.B., Bertók, G. and Bácsmegi, G. (2013). Integrated Prospection Methods to Define Small-site Settlement Structure: a Case Study from Neolithic Hungary. *Archaeological Prospection*, 20 (1), pp. 1-10.

Salque, M., Bogucki, P.I., Pyzel, J., Sobkowiak-Tabaka, I., Grygiel, R., Szmyt, M. and Evershed, R.P. (2013). Earliest evidence for cheese making in the sixth millennium BC in northern Europe. *Nature*, 493, pp. 522-525.

Sánchez Priego, J.A. and Brenet, M. (2007). Approche expérimentale des modes de fabrication et de fonctionnement des herminettes de type Mureybet [Experimental approach to the manufacture and operating methods of Mureybet-type adzes]. In Astruc, L., Binder, D. and Briois, F. (Eds.), *Systèmes techniques et communautés du Néolithique précéramique au Proche-Orient: Actes du 5e colloque international: Fréjus, du 29 février au 5 mars 2004 [Technical Systems and Near Eastern PPN Communities: Proceedings of the 5th international Workshop: Fréjus, from February 29th to March 5th, 2004]*. Antibes: APDCA, pp. 33-46.

Sarris, A., Galaty, M.L., Yarkes, R.W., Parkinson, W.A., Gyucha, A., Billingsley, D.M. and Tate, R. (2004). Geophysical prospection and soil chemistry at the Early Copper Age settlement of Vésztő-Bikeri, Southeastern Hungary. *Journal of Archaeological Science*, 31, pp. 927-939.

Sauter, F., Jordis, U., Graf, A., Werther, W. and Varmuza, K. (2000). Studies in organic archaeometry I: Identification of the prehistoric adhesive used by the "Tyrolean Iceman" to fix his weapons. *ARKIVOC*, 5, pp. 735-747.

Sauter, F., Varmuza, K., Werther, W. and Stadler, P. (2002). Studies in organic archaeometry V: Chemical analysis of organic material found in traces on an Neolithic terracotta idol statuette excavated in lower Austria. *ARKIVOC*, 2002, pp. 54-60.

Schellmann, N.C. (2007). Animal glues: a review of their key properties relevant to conservation. *Studies in Conservation*, 52 (Sup 1), pp. 55-66.

Schenck, T. and Groom, P. (2018). The aceramic production of Betula pubescens (downy birch) bark tar using simple raised structures. A viable Neanderthal technique? *Archaeological and Anthropological Sciences*, 10, pp. 19-29.

Schick, T. (1986). Perishable Remains from the Nahal Hemar Cave. *Mitekufat Haeven: Journal of the Israel Prehistoric Society*, 19, pp. 95-97.

Schick, T. (1995). A 10,000 Year Old Comb from Wadi Murabba'at in the Judean Desert. *'Atiqot*, 27, pp. 199-202.

Schlichtherle, H. (1981). Ausgrabungen des "Projekt Bodensee-Oberschwaben" in Hornstaad [Excavations of the “Project Bodensee-Oberschwaben” in Hornstaad]. *Archäologische Nachrichten aus Baden*, 26, pp. 65-66.

Schlichtherle, H. (2005). Bad Buchau-Bachwiesen I: Neue Rettungsgrabungen in einer Pfahlbausiedlung der Schussenrieder Kultur am Federsee [Bad Buchau-Bachwiesen I: New Rescue Excavations in a Pile Dwelling of the Schussenried Culture at the Federsee]. Nachrichtenblatt *Arbeitskreis Unterwaserarchäologie*, 11/12, pp. 45-51.

Schmandt-Besserat, D. (2013). The plastered skulls. In Schmandt-Besserat, D. (Ed.), *Symbols at 'Ain Ghazal. 'Ain Ghazal Excavation Reports, Vol. 3*. Berlin: Ex Oriente, pp. 213-243.

Schmidt, P., Blessing, M., Rageot, M., Iovita, R., Pfleging, J., Nickel, K.G., Righetti, L. and Tennie, C. (2019). Birch tar production does not prove Neanderthal behavioral complexity. *PNAS*, 116 (36), pp. 17707-17711.

Schmidt, P., Blessing, M.A., Kock, T.J. and Nickel, K.G. (2021). On the performance of birch tar made with different techniques. *Heritage Science*, 9 (140), pp. 1-9.

Schmidt, P., Rageot, M., Blessing, M. and Tennie, C. (2020). The Zandmotor data do not resolve the question whether Middle Paleolithic birch tar making was complex or not. *PNAS*, 117 (9), pp. 4456-4457.

Schreiner, T. (2004). Mesoamerican lime burning technology: a possible model for incipient lime industries of the early Near East. In Delage, C. (Ed.), *The Last Hunter-Gatherer Societies in the Near East*. Oxford: John and Erica Hedges, pp. 249-262.

Scotsmans, E.M.J., Toksoy- Köksal, F., Brettell, R.C., Bessou, M., Corbineau, R., Lingle, A.M., Bouquin, D., Blanchard, P., Becker, K., Castex, D., Knüsel, C.J., Wilson, A.S. and Chapoulie, R. (2019). 'Not all that is white is lime' – White substances from archaeological burial contexts: analyses and interpretations. *Archaeometry*, 61 (4), pp. 809-827.

Séara, F., Bridault, A., Ducrocq, T. and Souffi, B. (2010). Chasser au Mésolithique: L'apport des sites de vallées du quart nord-est de la France [Hunting in the Mesolithic: The contribution of valley sites in the northeast quarter of France]. *Archéopages*, 28, pp. 26-35.

Sebök, K., Faragó, N., Hajdú, Z., Anders, A. and Raczky, P. (2013). Egy különleges kút és leletei Polgár-Csőszhalom késő Neolitikus településéről [A special well and its finds from the late Neolithic settlement of Polgár-Csőszhalom]. *Archaeologiai Értesítő*, 138, pp. 29-79.

Seligson, K.E., Ruiz, S.O. and Pingarrón, L.B. (2019). Prehispanic Maya burnt lime industries: Previous studies and future directions. *Ancient Mesoamerica*, 30, pp. 199-219.

Shaffer, G.D. (1993). An Archaeomagnetic Study of a Wattle and Daub Building Collapse. *Journal of Field Archaeology*, 20 (1), pp. 59-75.

Shaham, D., Grosman, L. and Goren-Inbar, N. (2010). The red-stained flint crescent from Gesher: new insights into PPNA hafting technology. *Journal of Archaeological Science*, 37 (8), pp. 2010-2016.

Sheldrick, C., Lowe, J.J. and Reynier, M.J. (1997). Palaeolithic Barbed Point from Gransmoor, East Yorkshire, England. *Proceedings of the Prehistoric Society*, 63, pp. 359-370.

Shields, J. (1984) [1985]. *Adhesives handbook: Third edition*. London: Butterworths.

Simmons, A.H. (2012). Ais Giorkis: An unusual early Neolithic settlement in Cyprus. *Journal of Field Archaeology*, 37 (2), pp. 1-18.

Simmons, A.H. and Rollefson, G.O. (1984). Neolithic 'Ain Ghazal (Jordan): Interim Report on the First Two Seasons, 1982–1983. *Journal of Field Archaeology*, 11 (4), pp. 387-395.

Simmons, A.H., Boulton, A., Butler, C.R., Kafafi, Z. and Rollefson, G.O. (1990). Field Report: A Plastered Human Skull from Neolithic 'Ain Ghazal, Jordan. *Journal of Field Archaeology*, 17 (1), pp. 107-110.

Simmons, A.H., Rollefson, G.O., Kafafi, Z., Mandel, R.D., al-Nahar, M., Cooper, J., Köhler-Rollefson, I. and Durand, K.R. (2001). Wadi Shu'eib, A Large Neolithic Community in Central Jordan: Final Report of Test Investigations. *Bulletin of the American Schools of Oriental Research*, 321, pp. 1-39.

Singer, A. (2007). *The Soils of Israel*. Berlin: Springer.

Skeist, I. (1990). *Handbook of Adhesives: Third Edition*. New York: Van Nostrand Reinhold.

Slah, G. (2014). Flint artefact manufacture techniques at the Palaeolithic and Mesolithic settlements at Aukštumala in Lithuania, and traceological studies of them. *Archaeologia Baltica*, 20, pp. 190-199.

Slon, V., Sarig, R., Hershkovitz, I., Khalaily, H. and Milevski, I. (2014). The Plastered Skulls from the Pre Pottery Neolithic B Site of Yiftahel (Israel) – A Computed Tomography-Based Analysis. *PLoS ONE*, 9 (2), e89242. DOI: https://doi.org/10.1371/journal.pone.0089242.

Šoberl, L., Horvat, M., Gašparič, A.Ž., Sraka, M., Evershed, R. and Budja, M. (2014). Neolithic and Eneolithic activities inferred from organic residue analysis of pottery from Mala Triglavca, Moverna vas and Ajdovska jama, Slovenia. *Documenta Praehistorica*, 41, pp. 149-179.

Soják, M. and Furman, M. (2018). Liptovské Matiašovce-Bochníčky site: A new Neolithic settlement in the region of Liptov (central Slovakia). Acta *Archaeologica Carpathica*, 53, pp. 57-76.

Solazzo, C., Courel, B., Connan, J., van Dongen, B.E., Barden, H., Penkman, K., Taylor, S., Demarchi, B., Adam, P., Schaeffer, P., Nissenbaum, A., Bar-Yosef, O. and Buckley, M. (2016). Identification of the earliest collagen- and plant-based coatings from Neolithic artefacts (Nahal Hemar cave, Israel). *Nature: Scientific Reports*, 6, 31053. DOI: http://doi.org/10.1038/srep31053.

Solecki, R.S. (1963). Prehistory in Shanidar Valley, Northern Iraq. *Science*, 139 (3551), pp. 179-193.

Solecki, R.S., Solecki, R.L. and Agelarakis, A.P. (2004). *The Proto-Neolithic Cemetery in Shanidar Cave*. College Station: Texas A&M University Press.

Sørensen, M., Lübke, H. and Groß, D. (2018). The Early Mesolithic in Southern Scandinavia and Northern Germany. In Milner, N., Conneller, C. and Taylor, B. (Eds.), *Star Carr Volume 1: A Persistent Place in a Changing World*. York: White Rose University Press, pp. 305-329.

Soudský, B. (1962). The Neolithic Site of Bylany. *Antiquity*, 36, pp. 190-200.

Spataro, M. (2006). Pottery typology versus technological choices: An early Neolithic case study from Banat (Romania). *Analele Banatului*, 14, pp. 63-77.

Speth, J.D. (2015). When Did Humans Learn to Boil? *PaleoAnthropology*, 2015, pp. 54-67.

Spurrell, F.C.J. (1892). Notes on Early Sickles. *The Archaeological Journal*, 49 (1), pp. 53-68.

Stahlschmidt, M.C., Miller, C.E., Kandel, A.W., Goldberg, P. and Conard, N.J. (2017). Site formation processes and Late Natufian domestic spaces at Baaz Rockshelter, Syria: A micromorphological perspective. *Journal of Archaeological Science: Reports*, 12, pp. 499-514.

Ştefan, C.E. (2018). Impressed vessel bottoms from Şoimuş-La Avicola (Ferma 2), Hunedoara County, Romania. *The Old Potter's Almanack*, 23 (1), pp. 15-26.

Stern, B., Clelland, S.J., Nordby, C.C. and Urem-Kotsou, D. (2006). Bulk stable light isotopic ratios in archaeological birch bark tars. *Applied Geochemistry*, 21, pp. 1668-1673.

Stika, H.-P. (1996). Cultivated plant remains of the late Neolithic Michelsberg Culture at Heilbronn-Klingenberg (southwest Germany) - a comparison of different features, find assemblages and preservation conditions relating to the representation of archaeobotanical remains. *Vegetation History and Archaeobotany*, 5, pp. 57-64.

Stika, H.-P. (2005). Early Neolithic agriculture in Ambrona, Provincia Soria, central Spain. *Vegetation History and Archaeobotany*, 14, pp. 189-197.

Stöckl, H. and Westermann, E. (2004). Bandkeramik und Hinkelstein im nördlichen Kaiserstuhlvorland [Linear Pottery Culture and Hinklestein in the northern Kaiserstuhl foothills]. *Archäologische Nachrichten aus Baden*, 68/69, pp. 5-20.

Stojanovski, D., Živaljević, I., Dimitrijević, V., Dunne, J., Evershed, R.P., Balasse, M., Dowle, A., Hendy, J., McGrath, K., Fischer, R., Speller, C., Jovanović, J., Casanova, E., Knowles, T., Balj, L., Naumov, G., Putica, A., Starović, A. and Stefanović, S. (2020). Living off the land: Terrestrial-based diet and dairying in the farming communities of the Neolithic Balkans. *PLoS ONE*, 15 (8), e0237608. DOI: https://doi.org/10.1371/journal.pone.0237608.

Stordeur, D. and Khawam, R. (2007). Les crânes surmodelés de Tell Aswad (PPNB, Syrie). Premier regard sur l'ensemble, premières réflexions. *Syria: Archéologie, Art et Histoire*, 84, pp. 5-32.

Stratouli, G. (2005). Symbolic behaviour at places of social activity beyond the domestic area in the Ionian Neolithic. *Documenta Praehistorica*, 32, pp. 123-132.

Stratouli, G., Triantaphyllou, S., Bekiaris, T. and Katsikaridis, N. (2010). The manipulation of death: a burial area at the Neolithic Settlement of Avgi, NW Greece. *Documenta Praehistorica*, 37, pp. 95-104.

Strouhal, E. (1973). Five Plastered Skulls from Pre-Pottery Neolithic B Jericho: Anthropological Study. *Paléorient*, 1 (2), pp. 231-247.

Suter, P.J., Hafner, A. and Glauser, K. (2005). Lenk - Schnidejoch. Funde aus dem Eis - ein vor- und frühgeschichtlicher Passübergang [Lenk - Schnidejoch. Finds from the ice - a prehistoric and early historic pass crossing]. In Suter, P.J. and Ramstein, M. (Eds.), *Archäologie im Kanton Bern, Band 6B [Archaeology in the Canton of Bern, Volume 6B]*. Bern: Archäologischen Dienst des Kantons Bern, pp. 499-522.

Svobodová, E. (2014). Artefacts from organic materials in Neolithic graves: selected cases. *Studia Archaeologica Brunensia*, 19, pp. 5-21.

Sweatt, H.B. (1946). The Properties of Animal Glue. *Journal of Chemical Education*, 23 (4), pp. 192-194.

Sweetman, P.D., O'Sullivan, V.R., Gunn, H.M., Monk, J., Donnabháin, B.Ó. and Scannell, M. (1985). A Late Neolithic/Early Bronze Age Pit Circle at Newgrange, Co. Meath. *Proceedings of the Royal Irish Academy: Archaeology, Culture, History, Literature*, 85C, pp. 195-221.

Szakmány, G., Vanicsek, K., Bendő, Z., Kreiter, A., Pető, Á., Lisztes-Szabó, Z. and Horváth, J. (2019). Petrological Analysis of Late Neolithic Ceramics from the Tell Settlement of Gorzsa (South-East Hungary). In Amicone, S., Quinn, P.S., Marić, M., Mirković-Marić, N. and Radivojević, M. (Eds.), *Tracing Pottery-Making Recipes in the Prehistoric Balkans 6th–4th Millennia BC.* Oxford: Archaeopress, pp. 156-171.

Szeliga, M., Przeździecki, M. and Gabarek, A. (2019). Podlesie, Site 6 – the First Obsidian Inventory of the Linear Pottery Culture Communities from the Połaniec Basin. *Archaeologia Polona*, 57, pp. 197-211.

Takaoğlu, T., Korkut, T., Erdoğu, B. and Işın, G. (2014). Archaeological evidence for 9th and 8th millennia BC at Girmeler Cave near Tlos in SW Turkey. *Documenta Praehistorica*, 41, pp. 111-118.

Tankersley, K.B. (1994). Clovis Mastic and its Hafting Implications. *Journal of Archaeological Science*, 21, pp. 117-124.

Tarifa-Mateo, N., Clop-García, X., Rosell-Melé, A., Camalich-Massieu, M.D., Comes-Bordas, P., Martín-Socas, D., Nonza-Micaelli, A. and Rodríguez-Santos, F.J. (2019). New insights from Neolithic pottery analyses reveal subsistence practices and pottery use in early farmers from Cueva de El Toro (Málaga, Spain). *Archaeological and Anthropological Sciences*, 11, pp. 5199-5211.

Tasić, N., Marić, M., Penezić, K., Filipović, D., Borojević, K., Russell, N., Reimer, P., Barclay, A., Bayliss, A., Borić, D., Gaydarska, B. and Whittle, A. (2015). The end of the affair: formal chronological modelling for the top of the Neolithic tell of Vinča-Belo Brdo. *Antiquity*, 89 (347), pp. 1064-1082.

Tauxier, L. and Brunel, A. (1912). *The black population of the Sudan, Mossi and Gourounsi country, documents and analyses*. Paris: Emile Larose.

Teoh, M.L., McClure, S.B. and Podrug, E. (2014). Macroscopic, petrographic and XRD analysis of Middle Neolithic figulina pottery from central Dalmatia. *Journal of Archaeological Science*, 50, pp. 350-358.

Terradas, X., Clemente, I. and Gibaja, J.F. (2014). Mining tools use in a mining context or how can the expected become unexpected. In Brandl, M. (Ed.), *Proceedings of the 2nd International Conference of the UISPP Commission on Flint Mining in Pre- and Protohistoric Times (Madrid, 14-17 October 2009)*. BAR International Series, 2260. Oxford: Archaeopress, pp. 737-741.

Terradas, X., Piqué, R., Palomo, A., Antolín, F., López, O., Revelles, J. and Buxó, R. (2017). Farming Practices in the Early Neolithic According to Agricultural Tools: Evidence from La Draga Site (Northeastern Iberia). In García-Puchol, O. and Salazar-García, D.C. (Eds.), *Times of Neolithic Transition along the Western Mediterranean*. Basel: Springer International, pp. 199-220.

Thuesen, I. and Gwozdz, R. (1982). Lime plaster in Neolithic Hama, Syria. A preliminary report. *Paléorient*, 8 (2), pp. 99-103.

Toffolo, M.B., Ullman, M., Caracuta, V., Weiner, S. and Boaretto, E. (2017). A 10,400-year-old sunken lime kiln from the Early Pre-Pottery Neolithic B at the Nesher-Ramla quarry (el-Khirbe), Israel. *Journal of Archaeological Science: Reports*, 14, pp. 353-364.

Tomasso, S., Rots, V., Perdaens, Y., Crombé, P. and Meylemans, E. (2015). Hunting with trapezes at Bazel-Sluis: the results of a functional analysis. *Notae Praehistoricae*, 35, pp. 239-251.

Tomlinson, N.E. (2001). *Residue analysis of segments, backed and obliquely backed blades from the Howiesons Poort layers of Rose Cottage Cave, South Africa*. Unpublished: University of the Witwatersrand. MA.

Torchy, L. and Gassin, B. (2019). Le silex bédoulien sur les sites chasséens du Languedoc: étude fonctionnelle, statut des sites et réseaux de diffusion Bedoulian flint on the Chasséen sites of Langeudoc: functional study, site status and distribution networks]. *Gallia Préhistoire*, 53, pp. 59-84.

Torfing, T.D. (2013). The Network of Style: An analytical study of style and pottery from two causewayed enclosures. *Journal of Neolithic Archaeology*, 15, pp. 64-87.

Tóth, P., Malíšková, J., Nývltová Fišáková, M., Novotný, J., Hons, D., Čerevková, A. and Kazdová, E. (2020). Intra-site analýza sídliskového odpadu ako prameň poznania života človeka v Neolite [Intra-site analysis of the settlement waste as the source of knowledge of the life in the Neolithic]. In Cheben, I., Kalábková, P. and Metlička, M. (Eds.), *Otázky Neolitu a Eneolitu našich krajín – 2017–2019 [Questions of the Neolithic and Eneolithic of our countries – 2017-2019].* Archaeologica Slovaca Monographiae Communicationes, Tomus XXVI. Nitra, Olomouc and Plzeň: Archeologický ústav SAV, Univerzita Palackého v Olomouci and Západočeské muzeum v Plzni, p. o., pp. 247-280.

Turrado Moreno, A. and Muirden, S. (1945). *Ethnography of the Guarauno Indians*. Caracas: Vargas.

Twiss, K.C., Bogaard, A., Bogdan, D., Carter, T., Charles, M.P., Farid, S., Russell, N., Stevanović, M., Nurcan Yalman, E. and Yeomans, L. (2008). Arson or Accident? The Burning of a Neolithic House at Çatalhöyük, Turkey. *Journal of Field Archaeology*, 33 (1), pp. 41-57.

Urem-Kotsou, D., Copley, M.S. and Evershed, R.P. (2004). The use of birch bark tar on Late Neolithic pottery from Stavroupoli, North Greece. In Grammenos, D.B. and Kotsos, S. (Eds.), *Sostikes anaskafes sto Neolithiko oikiso Staypoypolis Thessalonikis: Meros II (1998-2003) [Rescue Excavations in the Neolithic Settlement of Stavroupoli, Thessaloniki: Part II (1998-2003)].* Publications of the Archaeological Institute of Northern Greece, 6. Thessaloniki: Archaeological Institute of Northern Greece, pp. 339-347.

Urem-Kotsou, D., Stern, B., Heron, C. and Kotsakis, K. (2002). Birch-bark tar at Neolithic Makriyalos, Greece. *Antiquity*, 76, pp. 962-967.

Urem-Kotsou, D., Mitkidou, S., Dimitrakoudi, E., Kokkinos, N. and Ntinou, M. (2018). Following their tears: Production and use of plant exudates in the Neolithic of North Aegean and Balkans. *Quaternary International*, 496, pp. 68-79.

Vahur, S., Kriiska, A. and Leito, I. (2011). Investigation of the adhesive residue on the flint insert and the adhesive lump found from the Pulli early Mesolithic settlement site (Estonia) by micro-ATR-FT-IR spectroscopy. *Estonian Journal of Archaeology*, 15 (1), pp. 3-17.

Van de Velde, T. (2015a). Digging into the 'Ubaid period bitumen from Dosariyah. *Proceedings of the Seminar for Arabian Studies*, 45, pp. 405-416.

Van de Velde, T. (2015b). *Black Magic Bitumen: An Archaeometrical Approach to 5000 years of Bitumen Imports in the Persian Gulf.* Unpublished: University of Ghent. PhD.

Van de Velde, T., De Vrieze, M., Surmont, P., Bodé, S. and Drechsler, P. (2015). A geochemical study on the bitumen from Dosariyah (Saudi-Arabia): tracking Neolithic-period bitumen in the Persian Gulf. *Journal of Archaeological Science*, 57, pp. 248-256.

Van Gijn, A. (2008). Toolkits and technological choices at the Middle Neolithic site of Schipluiden, The Netherlands. In Longo, L. and Skakun, N. (Eds.), *Proceedings of the Congress "Prehistoric Technology: 40 years later Functional Studies and the Russian Legacy." Verona, Italy, 20–23 April 2005.* Oxford: Archaeopress, pp. 217-225.

Van Gijn, A. and Boon, J. (2006). Birch bark tar. In Louwe Kooijmans, L.P. and Jongste, P.F.B. (Eds.), *Schipluiden: A Neolithic Settlement on the Dutch North Sea Coast, c. 3500 Cal BC.* Leiden: Leiden University, pp. 261-266.

Van Gijn, A. and Schallig, M.-C. (1997). Functional analysis of lithic implements. *Steinalderundersokelsene pa Rodsmoen*, 41, pp. 159-163.

Van Peer, P., Rots, V. and Vermeersch, P.M. (2008). A Wasted Effort at the Quarry: Wear Analysis and Interpretation of an MSA Lanceolate Point from Taramsa-8, Egypt. *PaleoAnthropology*, 2008, pp. 234-250.

Vardi, J. and Gilead, I. (2013). Keeping the razor sharp: hafting and maintenance of sickles in the southern Levant during the 6th and 5th millennia bc. In Borrell, F., Ibáñez, J.J. and Molist, M. (Eds.), *Stone Tools in Transition: From Hunter-Gatherers to Farming Societies in the Near East:*

7th Conference on PPN Chipped and Ground Stone Industries of the Fertile Crescent. Bellaterra: Universitat Autònoma de Barcelona, pp. 377-394.

Vardi, J., and Mizrahi, S. (2019). Moẓa. *Hadashot Arkheologiyot: Excavations and Surveys in Israel*, 131, Preliminary Report. [Online]. Available at https://www.hadashot-esi.org.il/Report_Detail_eng.aspx?print=nopic&id=25649&mag_id=127.

Vardi, Y., Yegorov, D. and Eisenberg-Degen, D. (2014). Har Harif. *Hadashot Arkheologiyot: Excavations and Surveys in Israel*, 126, Preliminary Report. [Online]. Available at http://www.hadashot-esi.org.il/report_detail_eng.aspx?id=13676&mag_id=121.

Vaughan, P. (1987). Positive and Negative Evidence for Hafting on Flint Tools from Various Periods (Magdalenian through Bronze Age). In D. Stordeur-Yedid (Ed.), *La Main et l'Outil: manches et emmanchements préhistoriques: Table ronde C.N.R.S. Tenue à Lyon du 26 au 29 Novembre 1984 [The Hand and the Tool: prehistoric handles and fittings: C.N.R.S. round table held in Lyon from November 26 to 29, 1984]*. Lyon: Maison de l'Orient et de la Méditerranée, pp. 134-144.

Vergély, H., Gandelin, M. and Garnier, N. (2012). Un lot de céramique singulier dans une sépulture du Chasséen ancient [A unique group of ceramics in an ancient Chasséen burial]. *Archéopages*, 3, pp. 95-97.

Verheye, W.H. and Boyadgiev, T.G. (1997). Evaluating the land use potential of gypsiferous soils from field pedogenic characteristics. *Soil Use and Management*, 13, pp. 97-103.

Veronika, S. and György, S. (2007). Petrographic and geochemical study of ceramics of Neolithic settlements on the northern boundary of the Great Hungarian Plain - Tiszaszőlős-Domaháza (Körös Culture) and Füzesabony-Gubakút (Alp Culture, Szatmár Group). *Archeometriai Műhely*, 2007/3, pp. 31-46.

Viberg, A., Berntsson, A. and Lidén, K. (2013). Archaeological prospection of a high altitude Neolithic site in the Arctic mountain tundra region of northern Sweden. *Journal of Archaeological Science*, 40, pp. 2579-2588.

Villa, P., Pollarolo, L., Degano, I., Birolo, I., Pasero, M., Biagioni, C., Douka, K., Vinciguerra, R., Lucejko, J.J. and Wadley, L. (2015). A Milk and Ochre Paint Mixture Used 49,000 Years Ago at Sibudu, South Africa. *PLoS ONE*, 10 (6), e0131273. DOI: https://doi.org/10.1371/journal.pone.0131273.

Villa, P., Soriano, S., Tsanova, T. and Beaumont, P.B. (2012). Border Cave and the beginning of the Later Stone Age in South Africa. *PNAS*, 109 (33), pp. 13208-13213.

Vogt, E. (1949). The Birch as a Source of Raw Material during the Stone Age. *Proceedings of the Prehistoric Society*, 5, pp. 50-51.

Lisch, G.C.F. (1845). *Jahrbücher des Vereins für Mecklenburgische Geschichte und Altertumskunde, aus Arbeins des Vereins. Zehnter Jahrgang. [Yearbook of the Association for Mecklenburg History and Antiquities. Tenth Year]*. Schwerin: Stillerschen Hofbuchhandlung.

Vouga, P. (1928). The Oldest Swiss Lake-dwellings. *Antiquity*, 2 (8), pp. 387-417.

Vouzaxakis, K. (2001). A new Neolithic site in Thessaly (Greece): the Belitsi magoula. *Antiquity*, 75, pp. 15-16.

Wadley, L. (2005). Putting ochre to the test: replication studies of adhesives that may have been used for hafting tools in the Middle Stone Age. *Journal of Human Evolution*, 49 (5), pp. 587-601.

Wadley, L., Hodgskiss, T. and Grant, M. (2009). Implications for complex cognition from the hafting of tools with compound adhesives in the Middle Stone Age, South Africa. *PNAS*, 106 (24), pp. 9590-9594.

Wadley, L., Williamson, B. and Lombard, M. (2004). Ochre in hafting in Middle Stone Age southern Africa: a practical role. *Antiquity*, 78 (301), pp. 661-675.

Wärmländer, S.K.T.S., Sholts, S.B., Erlandson, J.M., Gjerdrum, T. and Westerholm, R. (2011). Could the Health Decline of Prehistoric California Indians be Related to Exposure to Polycyclic Aromatic Hydrocarbons (PAHs) from Natural Bitumen? *Environmental Health Perspectives*, 119 (9), pp. 1203-1207.

Warren, G., Fraser, S., Clarke, A., Driscoll, K., Mitchell, W. and Noble, G. (2018). Little House in the Mountains? A small Mesolithic structure from the Cairngorm Mountains, Scotland. *Journal of Archaeological Science: Reports*, 18, pp. 936-945.

Watts, I. (2002). Ochre in the Middle Stone Age of southern Africa: ritualised display or hide preservative? *The South African Archaeological Bulletin*, 57 (175), pp. 1-14.

Watts, I. (2009). Red ochre, body painting and language: interpreting the Blombos ochre. In Botha, R. and Knight, C. (Eds.), *The Cradle of Language*. Oxford: Oxford University Press, pp. 93-129.

Watts, I. (2010). The pigments from Pinnacle Point Cave 13B, Western Cape, South Africa. *Journal of Human Evolution*, 59 (3-4), pp. 392-411.

Weisshaar, H. and Shipman, M. (1988). *Violin Restoration: A Manual for Violin Makers*. Los Angeles: Weisshaar-Shipman.

Wendt, W.E. (1976). 'Art Mobilier' from the Apollo 11 Cave, South West Africa: Africa's Oldest Dated Works of Art. *The South African Archaeological Bulletin*, 31 (121/122), pp. 5-11.

Wernecke, D.C. (2008). A burning question: Maya lime technology and the Maya forest. *Journal of Ethnobiology*, 28 (2), pp. 200-210.

White, C.E. and Makarewicz, C.A. (2012). Harvesting practices and early Neolithic barley cultivation at el-Hemmeh, Jordan. *Vegetation History and Archaeobotany*, 21, pp. 85-94.

Whitlam, J., Reza Valipour, H. and Charles, M. (2019). Cutting the Mustard: New Insights Into the Plant Economy of Late Neolithic Tepe Khaleseh (Iran). *Iran*, 58 (2), pp. 149-166.

Wierer, U., Arrighi, S., Bertola, S., Kaufmann, G., Baumgarten, B., Pedrotti, A., Pernter, P. and Pelegrin, J. (2018). The Iceman's lithic toolkit: Raw material, technology, typology and use. *PLoS ONE*, 13 (6), e0198292. DOI: https://doi.org/10.1371/journal.pone.0198292.

Williamson, B.S. (1996). Preliminary stone tool residue analysis from Rose Cottage Cave. *Southern African Field Archaeology*, 5 (1), pp. 36-44.

Williamson, B.S. (1997). Down the microscope and beyond: microscopy and molecular studies of stone tool residues and bone samples from Rose Cottage Cave. *South African Journal of Science*, 93, pp. 458-464.

Williamson, B. (2004). Middle Stone Age tool function from residue analysis at Sibudu Cave. *South African Journal of Science*, 100, pp. 174-178.

Wojcieszak, M. and Wadley, L. (2018). Raman spectroscopy and scanning electron microscopy confirm ochre residues on 71 000-year-old bifacial tools from Sibudu, South Africa. *Archaeometry*, 60 (5), pp. 1062-1076.

Wojtczak, D. and Kerdy, M. (2018). They left traces. Preliminary analyses of micro-wear traces on bone and antler tools from Sutz-Lattrigen Aussen, Lake Bienne, Switzerland. *Journal of Archaeological Science: Reports*, 17, pp. 798-808.

Wojtczak, D., Regert, M., Mazuy, A., Kerdy, M. and Leuzinger, U. (2016). *A functional analysis of some stone and bone implements from Neolithic lake dwelling sites: Arbon-Bleiche 3 and Sutz-Lattrigen Aussen, Switzerland.* Poster presented at 'Wetland Archaeology Research Project 30th Anniversary Meeting' 28th June – 2nd July 2016. University of Bradford.

Wragg Sykes, R.M. (2015). To see a world in a hafted tool: Birch pitch composite technology, cognition and memory in Neanderthals. In Coward, F., Hosfield, R., Pope, M. and Wenban-Smith, F. (Eds.), *Settlement, Society and Cognition in Human Evolution: Landscapes in Mind*. Cambridge: Cambridge University Press, pp. 117-137.

Wu, M., Zhang, B., Jiang, L., Wu, J. and Sun, G. (2018). Composite projectiles and hafting technologies at Ohalo II (23 ka, Israel): analyses of impact fractures, morphometric characteristics and adhesive remains on microlithic tools. *Journal of Archaeological Science*, 100, pp. 80-87.

Wymer, J. and King, J.E. (1962). Excavations at the Maglemosian Sites at Thatcham, Berkshire, England. *Proceedings of the Prehistoric Society*, 28, pp. 329-361.

Yakar, R. and Hershkovitz, I. (1988). Nahal Hemar Cave: The Modelled Skulls. *'Atiqot*, 18, pp. 59-63.

Yaroshevich, A., Nadel, D. and Tsatskin, A. (2013). Composite projectiles and hafting technologies at Ohalo II (23 ka, Israel): analyses of impact fractures, morphometric characteristics and adhesive remains on microlithic tools. *Journal of Archaeological Science*, 40 (11), pp. 4009-4023.

Yates, A.B., Smith, A.M., Bertuch, F., Gehlen, B., Gramsch, B., Heinen, M., Joannes-Boyau, R., Scheffers, A., Parr, J. and Pawlik, A. (2015). Radiocarbon-dating adhesive and wooden residues from stone tools by Accelerator Mass Spectrometry (AMS): challenges and insights encountered in a case study. *Journal of Archaeological Science*, 61, pp. 45-58.

Yerkes, R.W., Khalaily, H. and Barkai, R. (2012). Form and Function of Early Neolithic Bifacial Stone Tools Reflects Changes in Land Use Practices during the Neolithization Process in the Levant. *PLoS ONE*, 7 (8), e42442. DOI: https://doi.org/10.1371/journal.pone.0042442.

Zhilão, J. (2012). Personal Ornaments and Symbolism Among the Neanderthals. In Elias, S. (Ed.), *Origins of Human Innovation and Creativity*. Developments in Quaternary Science, 16. Amsterdam: Elsevier, pp. 35-49.

Zhilin, M. (2017). Mesolithic bone arrowheads from Ivanovskoye 7 (central Russia): Technology of the manufacture and use-wear traces. Quaternary International, 427 (B), pp. 230-244.

Zhilin, M. and Matiskainen, H. (2002). Deep in Russia, deep in the bog. Excavations at the Mesolithic Sites Stanovoje 4 and Sakhtysh 14, Upper Volga region. In Larsson, L., Kindgren, H., Knutssom, K., Leffler, D. and Akerlund, A. (Eds.), *Mesolithic on the Move*. Oxford: Oxbow Books, pp. 694-702.

Zhilin, M.G. (2017). Bone Massive Spear Heads in the Mesolithic of Western Russia (Technological and Functional Study). In Martínez Fernández, G. and Skakun, N.N. (Eds.), *Cuadernos de Prehistoria y Arqueología de le Universidad de Granada N.° 27, 2017 [Notebooks of Prehistory and Archaeology of the University of Granada N. 27, 2017]*. Granada: Editorial Universidad de Granada & Departmento de Prehistoria y Arqueología de la Universidad de Granada, pp. 211-244.

Zhilin, M.G. (2018). Mezoliticheskiye izdeliya iz kosti I roga iz nizhnego sloya stoyanki Ivanovskoye 7 v sobranii Mae Ran [Bone and antler Mesolithic artefacts from the bottom find level of Ivanovskoye 7 in the collection of Mae Ras]. *Camera Praehistorica*, 1, pp. 24-63.

Zipkin, A.M., Wagner, M., McGrath, K., Brooks, A.S. and Lucas, P.W. (2014). An Experimental Study of Hafting Adhesives and the Implications for Compound Tool Technology. *PLoS ONE*, 9 (11), e112560. DOI: https://doi.org/10.1371/journal.pone.0112560.