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A Key Palaeolithic Site Bridging Anatolia and the Aegean: Biber Deresi, Assos

Göknur Karahan[1] and **Nurettin Arslan**[2]

[1]*Department of Prehistory, Hacettepe University, Ankara, Türkiye*
[2]*Department of Archaeology, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye*
Corresponding Author: Göknur Karahan; Email: goknurkarahan@hacettepe.edu.tr

Biber Deresi is an open-air site located on the Assos/Behram, Çanakkale coast, associated with river systems and raw material sources. The site's particular importance is owed to the discovery of the most extensive Lower and Middle Palaeolithic assemblage yet identified on the Aegean coast of Türkiye. The lithic assemblage is characterized by a significant number of large cutting tools, including handaxes, cleavers, and trihedral picks, as well as pebble core tools, which are predominantly chopping tools. Flakes produced from both unprepared and prepared cores predominate. It is evident that, during the Pleistocene low sea level period, the region had a continuous connection with Lesvos and, via the eastern Aegean islands, with mainland Greece. Biber Deresi is identified as a key site, facilitating hominin movement and communication between Asia and Europe, and providing a novel contribution to the Palaeolithic map of the Aegean.

Keywords: Aegean, Çanakkale, Assos, Palaeolithic, Acheulean, lithic technology

Introduction

The traditional view of the dispersal of early humans into Eurasia and Europe is that it came directly from Africa. Consequently, the majority of proposed out-of-Africa scenarios focus on three main routes: Gibraltar, Sicily, and the Levant (Derricourt, 2005; Martínez-Navarro, 2010; O'Regan et al., 2011; Dinçer, 2016; Croitor, 2018; Taşkıran, 2018). The route that does not include sea crossings and is currently regarded as the most promising candidate, encompasses the Levant, Anatolia/Near East, and the Balkans. The most compelling evidence for this hypothesis is the widespread distribution of Acheulean material in the Levant and Anatolia. Over the course of the 130 years since the initial discovery of an Acheulean handaxe in Anatolia in Birecik, Şanlıurfa (Chantre, 1898), the number of handaxes has increased considerably, contingent upon both the quantity and quality of the research conducted (Yalçınkaya et al., 2009).

The Acheulean complex is a ubiquitous feature of the archaeological record in Türkiye and regarded as substantial proof of the mobility of hominin groups to Anatolia via the Levant corridor from Africa. When considering the evidence, it is unsurprising that the Acheulean collection of the southeastern and eastern Anatolian regions is more abundant than that of other regions (Taşkıran & Kartal, 1999, 2004; Taşkıran, 2008; Baykara et al., 2019, 2022). Similarly, research conducted in central Anatolia has yielded significant evidence of the presence

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of Acheulean material (Slimak & Dinçer, 2007; Balkan-Atlı et al., 2008; Slimak et al., 2008; Kuhn et al., 2015). While most of the data from these regions are derived from surveys, the existence of the Acheulean has also been corroborated by meticulous stratigraphic excavations that offer well-documented absolute dates. Furthermore, the dates of the *Homo erectus* remains discovered in Dmanisi (1.8 Mya, Georgia) (de Lumley et al., 2006) and Kocabaş (1.2 Mya, Türkiye) (Lebatard et al., 2014), i.e. considerably older than one million years ago, serve to reinforce the significance of Türkiye as a corridor.

In the Aegean and Marmara regions of Türkiye, which represent the extension of the migration of *Homo erectus* from Anatolia to Europe, the Acheulean is, however, primarily based on surveys that lack stratigraphic information and is represented by a limited number of lithics. While handaxes can be traced in the interior of the Aegean by a limited number of singular and non-classical examples (Kansu, 1963, 1969; Taşkıran & Taşkıran, 2011; Özçelik & Bulut, 2017, 2021; Birol 2018; Aydın et al., 2023; Özçelik & Karahan, 2023), except for Sürmecik (Taşkıran et al., 2021; Karahan et al., 2024a), the coastline remains a significant area of uncertainty. The coastal regions show only slight indications of Acheulean influence, discernible in Karaburun in Izmir (Çilingiroğlu et al., 2018) and Gökçeada in Çanakkale (Özbek & Erdoğu, 2014; Erdoğu et al., 2021). The studies conducted between 2021 and 2023 to elucidate the Palaeolithic of the Çanakkale–Balıkesir coastline are especially significant in this field, uncovering a wealth of new data (Bulut et al., 2022; Karahan et al., 2024b). The Thrace region of Türkiye, on the other hand, exhibits a structural and cultural profile markedly distinct from that of Anatolia, raising questions about the traditional view of Anatolia as a pivotal link in the dispersal of the Acheulean (Dinçer & Slimak, 2007a, 2007b). This highlights the need for further research into the Marmara–Thrace corridor, which has been identified as a potential route for the initial spread of hominins to Europe.

In recent years, research into the Palaeolithic in the Aegean has shifted the focus of research in the region from land to sea, introducing a new perspective on the mobility of hominins in the region (Lykousis, 2009; Sakellariou & Galanidou, 2016, 2017). This perspective challenges the long-held assumption that vast tracts of land in the northern Aegean and central Aegean were isolated from the Aegean Sea during the Early and Middle Pleistocene. Furthermore, the region challenges the prevailing terrestrial-centred perspective on hominin occupation in Europe and the routes they followed. The new data offer an alternative, or perhaps complementary, scenario; they are of high ecological significance and provide insights into the new opportunities and spaces that hominins may have exploited (Carter et al., 2019; Tsakanikou et al., 2021).

The Aegean Sea, which is often perceived as a barrier today due to the absence of terrestrial connection, may have functioned as a land bridge during the Pleistocene, playing a crucial role in early human mobility (Lykousis, 2009; Sakellariou & Galanidou, 2016, 2017). Considering this, the Palaeolithic data from the Aegean are inextricably linked to the region's geodynamic features. This geodynamic landscape has undergone significant transformations throughout the Quaternary, resulting in adverse effects on the preservation, availability, accessibility, and visibility of Early and Middle Pleistocene archaeological and palaeoanthropological data (Tourloukis, 2010). Aegean Palaeolithic research, which also encompasses western Anatolia, provides the most compelling explanation for the prolonged absence of Acheulean data.

Similarly, the site of Sürmecik, in the central Aegean region of Türkiye, underscores the significance of the site's geological archive, having been discovered beneath a layer of travertine deposits approximately 5 m thick (Taşkıran et al., 2021; Karahan et al., 2024a). It seems plausible to suggest that comparable processes were at work in the low-density Acheulean landscape along the Aegean coastline, in comparison to other regions of Anatolia.

Biber Deresi, discussed in this article, reveals the most intense evidence of Acheulean components (handaxes, picks, and cleavers) on the northern Aegean coastline of Anatolia. Located near the coastal settlement of Assos/Behram, it is an open-air site comprising a Lower and Middle Palaeolithic component. It is evident that, during the low sea levels of the Pleistocene, the area had an uninterrupted connection with both Lesvos and the Greek mainland through the eastern Aegean islands. In this context, Biber Deresi emerges as a pivotal site, facilitating the mobility and communication of hominins between Asia and Europe and offering a novel contribution to the Palaeolithic map of the Aegean.

Biber Deresi: Materials and Methodology

Biber Deresi is situated in the northern region of Edremit Bay, on the southern coastline of Çanakkale (Figure 1). Its geographic coordinates are 39°29'13"N and 26°19'13"E. The site lies 2 km to the southwest of the ancient city of Assos, within the village of Behram. It encompasses the lands to the east of the valley, where a stream designated as Biber Deresi flows. The Tuzla stream, which flows in a northeasterly direction parallel to Edremit Bay along the Çanakkale coastline to the north

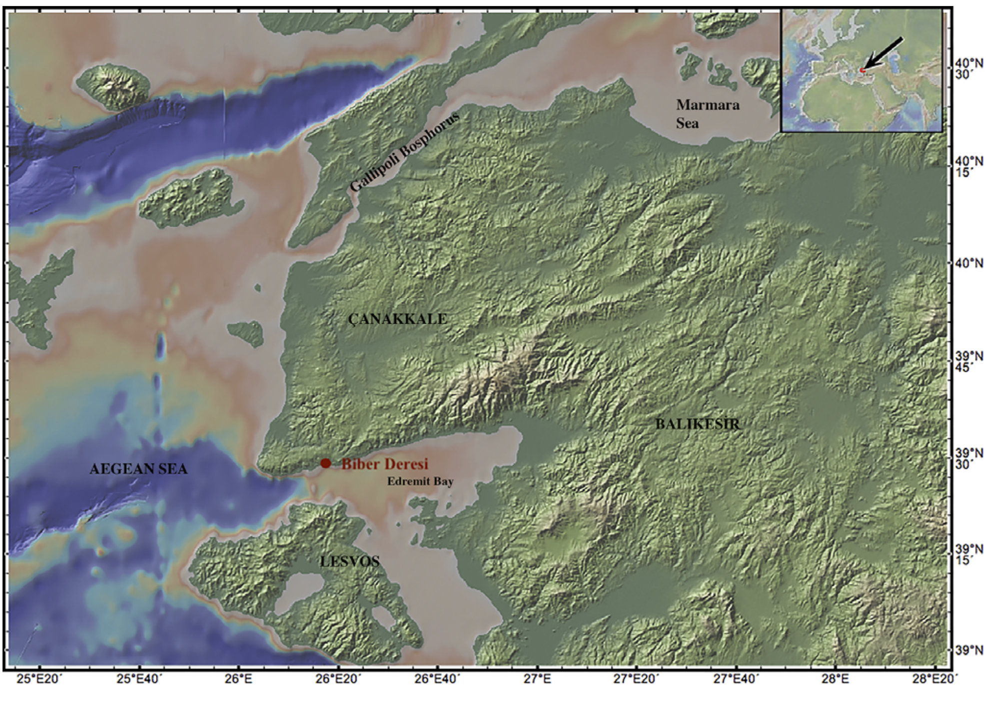

Figure 1. *Location of Biber Deresi.*

of Biber Deresi, discharges its waters from the terrain of Biber Deresi to the Müsellim Strait via a network of tributaries that flow perpendicularly. The region's current geographical features are the result of tectonic and geomorphological processes that began during the Miocene and continued until the Middle-Late Pleistocene (Ercan et al., 1995).

In 2021–2022, research was conducted in several geomorphological units, including high altitudes and coastlines (Karahan & Arslan, 2023). This revealed the presence of dense lithic deposits across a considerable area, spanning approximately 2 km^2 as measured in a straight line (Figure 2). Palaeolithic lithic finds were discovered in areas to the north of the west-southeast oriented ridge, which had been eroded by rainwater or seasonal stream beds. In this region, tectonic activity and potential flooding of the river have resulted in the secondary deposition of Palaeolithic finds.

The lithics were recovered from a variety of geographical contexts, including olive groves, low hills, and slopes (Figure 3), with findspots in dense maquis vegetation. In some instances, the area is distinguished by dense forest, particularly along the ridge. Consequently, visibility is restricted. However, lithics have been subjected to significant exposure in specific eroded areas. The findspots are associated with red-brown soils. In some of them, an embankment is situated on top of red agglomerate (volcanic breccia) in the vicinity (see Supplementary Material, Figure S1.2). The coastal section of the southern ridge, where the lithics were discovered, slopes down at a considerable angle and is predominantly characterized by rocky terrain rather than coastal features. Despite the absence of lithics in this area, basalt raw material was discernible, particularly in the south-western portion of the ridge. Flint raw material is widely distributed across the

Figure 2. *Distribution of Biber Deresi findspots, with the site of Assos in the foreground.*

Figure 3. *Detailed views of Biber Deresi. a) Biber Deresi basin; b) an eroded area; c) an uneroded area with partially dense vegetation (inset: a distally broken handaxe); d) density of lithics in the eroded area.*

landscape in the form of tubers and blocks. In contrast, quartz, quartzite, and limestone are typically observed in surface deposits as small and rounded nodules.

In 2021–2022, a total of 504 lithic artefacts from twelve different findspots were analysed (Figure 2). It is important to note, however, that the area in question exhibits a significantly higher concentration of lithics. Each findspot represents a coherent and contemporary assemblage, with lithic artefacts probably uncovered though processes of secondary deposition. Seasonal flooding and erosion from tributaries of the Tuzla stream appear to have played a central role in exposing these materials. Over time, shifts in the stream's course may have further influenced the location and visibility of artefacts within the surveyed area. These processes primarily reveal lithics where precipitation-dependent erosion has removed overlying sediments, which emphasizes the impact of natural forces on the archaeological record. Importantly, no significant differences in morphology or technology are evident among the assemblages, suggesting a consistent cultural horizon. The varying densities of artefacts across findspots reflect erosion patterns and visibility conditions more than distinct cultural phases. Detailed descriptions and images of each findspot can be found in Supplementary Material 1.

In the techno-typological analysis of lithics, all finds were examined in different categories, including large cutting tools, pebble core tools, retouched tools, cores, and their products. This was conducted using a combination of European and Levantine terminologies (Bordes, 1961; Debénath & Dibble, 1994; Shea, 2013). The lithic assemblage has been attributed to the Lower and Middle Palaeolithic based on techno-typological attributes. A considerable number of researchers have highlighted the potential misleading nature of making chronological references based on the techno-typological characteristics of materials collected in surveys (Darlas, 1999; Doboş & Iovita, 2016). While acknowledging this, surface material is nevertheless a valuable source of information, as it can indicate the presence or absence of human activity, particularly in regions where environmental change has occurred, as in the Aegean. Furthermore, the lithic assemblage does not exhibit the characteristics of a randomly distributed deposit and has been extensively recovered from an area that has been identified as a Palaeolithic site with potential boundaries. The emphasis is placed on the technological assemblage rather than on individual elements. The site has not yet been subjected to absolute dating, but this is currently underway. It is likely that the site can be attributed to a timespan between the Middle Lower Palaeolithic and the Early Middle Palaeolithic, with reference to the excavations at Rodafnidia, on Lesvos just across Biber Deresi, which yielded an Acheulean assemblage (Galanidou et al., 2016).

Lithics

The Biber Deresi lithic assemblage comprises a range of tools and products, including large cutting tools, pebble core tools, cores, retouched tools, and products (i.e. flakes, blades, and debris) (Table 1). The raw materials used in the production of these finds included flint (86.51%), basalt (0.40%), limestone (2.78%), quartz (5.56%), and quartzite (4.76%). Approximately eighty per cent of the finds were produced from high-quality and/or relatively high-quality raw materials, while twenty per cent were produced from poor-quality raw materials that adversely affect flaking due to reasons such as the presence of veins and porosity. A significant majority of the lithic artefacts, some eighty per cent, had pronounced evidence of abrasion and advanced patination, which can be attributed to the combined effects of intense erosional processes and prolonged exposure to abrasive environmental conditions. The high levels of surface erosion, likely to have been caused by seasonal flooding and the mechanical action of sediment-laden water, contributed significantly to the weathering of these artefacts. This phenomenon underscores the dynamic geomorphological setting of Biber Deresi, where lithic materials were subjected to continuous natural forces, resulting in the surface modification and deposition pattern observed today.

Large cutting tools

The assemblage comprises bifacial handaxes (n = 22), two trihedral picks, a cleaver, and three massive scrapers. Handaxes are convergent-pointed tools that have been shaped by bifacial techniques, either entirely or in part. Most of the examples from Biber Deresi do not exhibit a predominantly pointed morphology.

Archaic and symmetrical examples have been identified among these tools. According to the Flatness Index, most examples can be classified as thick handaxes (Flatness Index < 2.35), except for three, which belong to the flat variety (Flatness Index > 2.35) (see Supplementary Material Table S2.1). One of the flat handaxes is disc-shaped, one is oval, and one is cordiform (Figure 4a). The distal end of four of the thick handaxes is substantially broken, thus precluding identification to type. One of them may be of lanceolate or Micoquien

Table 1. Typological composition of the Biber Deresi lithic assemblage.

Typology/ Raw material		Flint	Basalt	Limestone	Quartz	Quartzite	Total n	Total %
Large cutting tools	*Handaxe*	17	–	1	3	1	22	4.37
n = 28	*Pick*	2	–	–	–	–	2	0.40
%5.56	*Cleaver*	1	–	–	–	–	1	0.20
	Massive scraper	2	–	1	–	–	3	0.60
Pebble core tools	*Chopper*	4	–	–	3	1	8	1.59
n = 43	*Chopping tool*	19	–	2	2	–	23	4.56
%8.53	*Core scraper*	11	1	–	–	–	12	2.38
Retouched tools	*Retouched flake*	60	–	1	3	3	67	13.29
n = 216	*Side scraper*	21	–	–	–	2	23	4.56
%42.86	*Notched*	32	–	1	3	3	39	7.74
	Denticulated	60	1	1	–	2	64	12.70
	Endscraper	4	–	1	–	–	5	0.99
	Backed knife	–	–	1	–	–	1	0.20
	Composite tool	3	–	–	–	1	4	0.79
	Truncation	1	–	–	–	–	1	0.20
	Rabot	10	–	–	2	–	12	2.38
Cores	*Prepared*	52	–	–	1	2	55	10.32
n = 98	*Non-prepared*	26	–	1	–	–	26	5.75
%19.44	*Tested*	5	–	–	–	–	5	0.99
	Core fragment	12	–	–	–	–	12	2.38
Products	*Flake*	84	–	4	10	9	107	21.23
n = 119	*Blade*	2	–	–	–	–	2	0.40
%23.61	*Clacton flake*	2	–	–	–	–	2	0.40
	Bipolar flake	–	–	–	1	–	1	0.20
	Levallois flake	1	–	–	–	–	1	0.20
	Debris	6	–	–	–	–	6	1.19
Total		437	2	14	28	24	**504**	**100**

type (Figure 3c, inset); since its distal end is broken, we cannot distinguish between the two forms.

Two handaxes display the proto-biface form described in the Levantine terminology proposed by Shea (2013: 57). The examples are of a diminutive size and thickness, yet they have been roughly shaped through the removal of substantial flakes. The handaxes, which are regarded as archaic forms according to the larger measurements, are defined as Abbevillian type handaxes in accordance with Debénath and Dibble's terminology (1994: 150) (Figure 5). Both surfaces of the handaxes were shaped by the removal of coarse flakes, with approximately thirty per cent of the cortex remaining. In contrast, another handaxe exhibits a straight or guillotine-shaped distal cutting edge, reminiscent of cleavers. This tool, with a form intermediate between a handaxe and a cleaver, is comparable to the tools designated as a *biface à biseau oblique* (Brézillon, 1971: 157). Similarly, a handaxe has been described as a 'bevelled biface' according to Debénath and Dibble's terminology (1994: 166) due to its form being similar to that of a cleaver. Handaxes of this form are cleaver-like tools with a distal cutting edge and a bifacial or single surface, formed by multiple flake removals from various directions.

One handaxe has been determined to be of Micoquien type (Figure 6a). It is notable for the concave feature present on

Figure 4. *Handaxes. a) cordiform type; b) short-thick almond type.*

both lateral sides. Two handaxes are of lageniform shape, i.e. bifaces characterized by a rounded base and a distal end that exhibits a constriction forming a neck with edges that are more or less parallel (Figure 6b); the length ratio of these handaxes is less than 1.5, indicating that they can be classified as short almonds (see Figure 4b). In addition to these, two other handaxes in the assemblage have a different morphology. Their length ratio is less than 1.5, which classifies them as short almonds, following Debénath and Dibble's (1994: 146) typology of amygdaloid bifaces. These handaxes are thicker variants of cordiform bifaces, similar in plan form but differing in their relative thickness. Thick *limande*-shaped (i.e. looking like a sole) and lanceolate-shaped handaxe were also identified.

Figure 5. *Handaxes. a–b) Abbevillian type.*

Trihedral picks are tools manufactured on nodules that have a triangular cross-section, comprising two pieces. The distal end is naturally thick and pointed (Supplementary Material Figure S1.14a). A cleaver is represented by one example (Supplementary Material Figure S1.14b) made on a large flake. The cutting edge is formed by flake removal, and there is no retouch. The width of the cutting edge is more than half the width of the tool. Massive scrapers (n = 3) are made on large flake blanks (see Figure 7a). Shaping is most often done with coarse flake removals on all edges. In the Biber Deresi examples, it is evident that the distal end is shaped and brought to the fore.

Pebble core tools

The pebble core tool set comprises choppers (n = 8), chopping tools (n = 23), and core scrapers (n = 12). The manufacture of choppers involves the use of flat raw material. Three of the tools are made of quartz,

Figure 6. *Handaxes. a) Micoquien type; b) lageniform type.*

one of quartzite, and the remaining use flint. These tools are characterized by a cutting edge formed by the removal of one or more flakes from a single face (Figure 8a). However, one example is a double chopper, with a cutting edge formed on two opposing edges (Figure 7b). The edge morphologies of these tools can be classified as concave (n = 2), convex (n = 3), or zigzag (n = 3). It is notable that approximately thirty per cent of the tool underwent flaking, while the remaining portions exhibit a cortical structure.

In contrast, chopping tools are defined as tools where one edge is shaped by the removal of flakes on both sides (Figure 8c–e). While there are also larger forms of these tools, smaller versions exist (Supplementary Material Table S2.2). The shaping of these tools is achieved through the removal of three or four flakes from each side of a single edge. Similarly, double chopping tools, comprising two opposing ends, are also represented in the assemblage (n = 2) (Figure 8d). Typically, half the raw material was intensively processed, with the other half made of

Figure 7. *Scrapers. a) massive scraper; b) core scraper.*

cortical parts. However, a sample has flaking exceeding fifty per cent, and the flake forming the cutting edge is classified as a core chopping tool due to the depth of the removals. The cutting-edge morphologies of these tools include convex (n = 5), concave (n = 4), S-shaped folds (n = 5), and zigzag shapes (n = 9).

The blanks of core scrapers are formed from flat, natural raw materials (Figure 7b). Thin forms such as plates were preferred (n = 7). One or more edges are shaped by coarse removals. Subsequently, fine retouches are made on top of the coarse retouches. Retouches are typically semi-steep or half-covering the surface.

Cores

The data indicate that among the cores, those prepared in advance are in the majority (10.32%), represented by specimens that show the use of the following techniques: Levallois (n = 25), para-Levallois (n = 25), discoid (n = 1), unidirectional (n = 3), and bidirectional (n = 1). Levallois cores are

Figure 8. *Pebble core tools. a–b) choppers; c–e) chopping tools.*

flaked using the recurrent methods. Four examples were made using Levallois lineal methods. Two cores were produced from high-quality grey quartzite, the remainder were made from flint. The final flaking surfaces are prepared by centripetal scars, with a preferential flake removal located at the centre of this surface. The striking platform preparation surfaces were meticulously crafted through centripetal flaking. A remnant of cortex is present in the middle of the preparation surface of the striking platform of all the cores. indicating that the cores were created using the classic 'tortoise-shaped' forms (Figure 9a). All the cores were created with the intention of producing flakes. There are twenty-one Levallois cores that were created using the recurrent Levallois method, which can be classified as bidirectional (n = 4), centripetal (n = 12),

Figure 9. *Prepared cores. a) Levallois lineal; b–c) Levallois recurrent; d) para-Levallois lineal; e) para-Levallois recurrent.*

orthogonal (n = 4), and unidirectional recurrent (n = 1), based on the orientation of the Levallois products flaked from the final flaking surface.

A unidirectional recurrent Levallois core is produced from split flint, which can be of relatively high quality. The final flaking surface was prepared by convergent orientation from the same striking plane, which is the same method as that used to prepare a Levallois point core (Figure 9b). However, products flaked from this surface are hinged and deeply removed, which affected the removal of Levallois points. The striking platform was also prepared by single-flake removal, which is not an effective method, but can be considered an element that affects the quality of flaking.

The final flaking surface of the bidirectional recurrent Levallois cores was prepared in a centripetal manner, although they were largely depleted (i.e. worked until no further blades could be produced). Consequently, two Levallois flakes removed from two opposing platforms are visible on the surface. From the perspective of the conventional Levallois technique, this approach is designed to produce a flaked Levallois blade from the cores. However, in addition to the way the raw material was exploited, the method of preparation and the dimensions of the raw material used play a significant role in determining the size and shape of the preferred product. Consequently, such cores are intended for flake production. On the final flaking surface of orthogonal recurrent cores, flake scars that intersect each other perpendicularly are evident.

The flaking surface of centripetal recurrent cores has been largely exhausted by preferential flakes, with only seven cores exhibiting partial cortex remnants in the centre of the striking platform of the preparation surface. Of these, three have undergone a process of exhaustion and were subsequently transformed into disc tools (Figure 9c).

Para-Levallois cores, in which Levallois flaking does not adhere to the criteria defined by Boëda (1995) regarding raw materials or technical application, are represented by twenty-five exemplars. In some cases, the flaking surface of the cores is not fully prepared, while in others the striking platform is not adequately prepared (Figure 9d–e). Partial remains of cortex were present on the flaking surface of most cores (n = 20). This has an impact on the form of the flake, which is determined by the preparation of the core's flaking surface. This can be seen as an indication of a lack of technical competence. Nevertheless, a considerable proportion of the Levallois flakes have been removed with hinges or steps (n = 13). This is indicative of the influence of the quality of the raw material on the application of the technique. Furthermore, the inability to adjust the intensity of the impact may result in the severance or hinging of the flake. The cores were exploited using a variety of techniques, including lineal (n = 8), centripetal recurrent (n = 5), unidirectional recurrent (n = 11), and bidirectional recurrent (n = 1). One of the cores was exploited to produce points, while the others were flaked to produce flakes. That core, which was flaked using the bidirectional recurrent method, yielded flakes with an elongated shape.

A single discoid core is present among the prepared cores. This core, which is intended for flake production, has two surfaces that intersect perpendicularly. Both surfaces display extensive centripetal flaking.

In the production of unidirectional cores, flint with an angular cubic form were employed. This form provides a naturally flat percussion platform for production. However, the striking platforms are simply prepared, albeit with a single-flake removal. Subsequently, peripheral flakes that intersect each other from this striking platform were produced. The bidirectional core is also intended for flake production. In a similar manner, the two opposing striking platforms are simply prepared by flake scars.

Unprepared cores are those in which flake production occurs in numerous directions (n = 26), contingent on the quality of the raw material. The cores are represented by a variety of forms, including globular (n = 4), semi-globular (n = 4), one-sided (n = 7), two-sided (n = 1), and multi-directional (n = 10). This classification is based on the way the flakes are oriented during production. In almost half of the core (n = 11), the poor quality of the raw material meant that the flakes broke off in a hinged manner. Except for one core, all the cores exhibited a range of proportions of cortex. which indicates that the cores have not been significantly depleted. Among the cores we analysed, some cores (n = 5) had one or two flakes removed. Only twenty per cent of the raw material from which these cores were produced was processed, while the remaining eighty per cent retained its cortex and was left unmodified.

Products

The products comprise flakes (n = 111), blades (n = 2), and debris from debitage (n = 6). The overwhelming majority of the products are manufactured from flint (n = 87). Infrequently, quartz (n = 11), quartzite (n = 9), and limestones (n = 4) were employed. Among the flakes, one was identified as a bipolar-on-anvil flake, one as a Levallois flake, and two as Clacton flakes. The bipolar-on-anvil flake was produced on quartz (Figure 10i), while a different flake presents a similar example made on flint (Figure 10h). They display a distinctive refractive quality at the two opposing ends of their inner surface, like a butt. The Levallois flakes exhibit centripetal

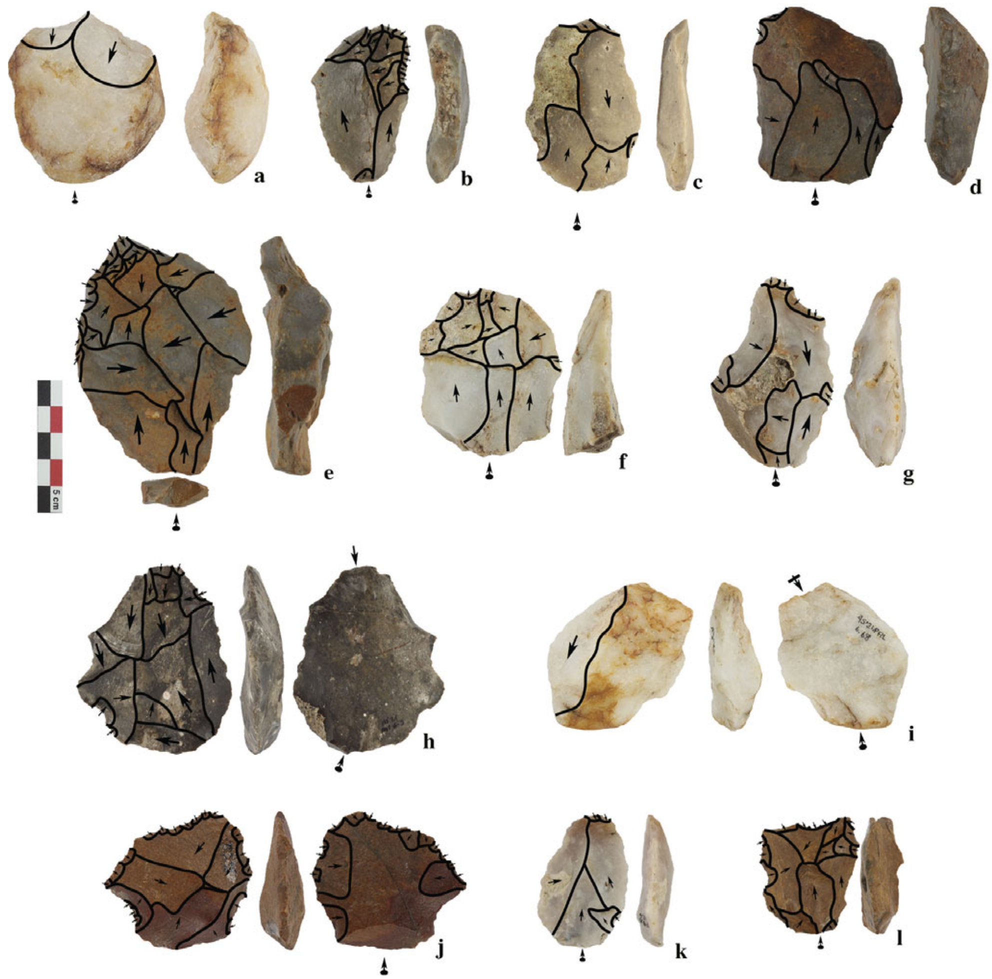

Figure 10. *Products and retouched tools.*

negatives on their dorsal surfaces and a dihedral configuration at the butt. In contrast, the Clacton flakes have a flat butt that is wide and oriented towards the interior. One has parallel left scars on the dorsal surface, while the other has orthogonal scars. In addition, a few primary flakes (approximately ten pieces) retain a considerable amount of cortex on the dorsal surface. Most flakes display either parallel (n = 46) or centripetal (n = 35) scars on their dorsal surfaces (Figure 10). The butts of these flakes are typically directed towards the interior (n = 61) and flat (n = 61). However, there are also lower numbers of flakes with cortical (n = 26), dihedral (n = 6), and facetted (n = 3) butts. The blades carry parallel negatives on their dorsal faces, directed proximally, and their butts are flat.

Retouched tools

The retouched tools represent nearly half (42.86%) of the assemblage. The majority of these tools were produced on flakes (n = 190). Additionally, a limited number of tools were produced on blades (n = 3) and on debitage from other knapping activities (n = 23). Three of the flakes show characteristics consistent with the Levallois technique: two of them display parallel negative scars on their dorsal faces, while the third exhibits an asymmetrically oriented scar. The butt of the tools is faceted. The butt of one of the Levallois flakes shows the hallmark characteristics of a *chapeau-de-gendarme* technique, which is typically employed in such instances. Six of the flakes exhibit Clacton characteristics, displaying butt types with a wide and inwardly sloping cortex. Two of the flakes are bipolar-on-anvil. The remaining flakes (n = 179) display a variety of scars on their dorsal faces, including parallel (n = 65), centripetal (n = 59), orthogonal (n = 29), and asymmetrically oriented (n = 3) scars. In contrast, primary flakes, which exhibit the entire dorsal face of the cortex, were used in shaping a relatively limited number of tools (n = 23). One of the blades from which the retouched tools were produced displays distinctive *débordant* properties (i.e. a flake taken from the edge of the core during the resharpening process, extending outward).

The shaping of retouched tools typically exhibits standard characteristics. Following the shaping process, the edge morphologies underwent moderate alteration (in 117 cases). Among the tools, the large number of retouched that show partial retouch is notable (Figure 10b, c–f, k). In addition, the assemblage also comprises denticulated (n = 64) and notched (n = 39) tools (Figure 10 g-h, j, l). The number of side scrapers with regular and continuous scales on the edges is relatively low (n = 23). The assemblage comprises several types, including single convex (n = 6), single flat (n = 3), single concave (n = 3), two convex (n = 2), two convex-concave (n = 1), two flat-convex (n = 1), transverse (n = 5), and convergent (n = 1). Of these, only five have stepped retouched modifications. The remaining tools display semi-steep scale retouched shaping. The tool assemblage includes a few end scrapers (n = 5), composite tools (n = 3), *rabots* (planning or wood-shaving tools) (n = 12), and backed knives (n = 1).

Discussion

The fieldwalking surveys conducted over two seasons in 2021–2022 in Biber Deresi were over a restricted area (2 km^2) that yielded a substantial lithic assemblage (Karahan, 2024). The lithic assemblage from this systematic fieldwork comprises 504 pieces, representing an average of approximately four lithics per m^2. When considered in the context of the twelve individual findspots from which the collection was assembled, this equates to an average of forty-two finds per findspot. The presence of more lithic material in the area should be underlined. Each findspot should be regarded as an area of denudation where lithics were recovered. It is probable that the lithics were deposited extensively in this area as secondary deposition due to flooding, and not necessarily through natural uncovering. In other areas with no erosion, lithics are not visible.

The Biber Deresi assemblage is characterized by the presence of a significant number of large cutting tools, including handaxes, cleavers, and trihedral picks, as well as pebble core tools, which are predominantly chopping tools. Flakes produced from both unprepared and prepared cores are also present. Of note is the high proportion of retouched tools, which account for almost half of the entire industry (42.86%). These tools are manufactured on flake blanks and are mainly composed of partially retouched tools and notched and denticulated tools. In the context of Levallois technology, recurrent flaking is a predominant technique, the primary objective being to produce flakes. It is notable for its distinctiveness among the cores prepared in forms defined as para-Levallois, as well as for its characteristic exemplars. Most handaxes are well preserved and intact. These include thick handaxes and a wide range of subtypes. The techno-typological analysis of the lithics clearly demonstrates the presence of Acheulean material in Biber Deresi. Additionally, there is a possibility that Middle Palaeolithic groups associated with retouched tools and Levallois technology were present. In the absence of absolute dates and stratigraphic excavations, the association of these handaxes with Lower Palaeolithic or Mousterian-of-Acheulean tradition remains an open question. Be that as it may, we have established that Biber Deresi contains the densest concentration of handaxes on the Aegean coast of Türkiye relative to the size of the area surveyed. Further research and documentation in the field are ongoing.

The archaeological record of the Lower Palaeolithic in the Aegean region is notably scarce. The data, which come from a few open-air sites and caves, are associated with the presence of high-quality raw material sources and river systems. This feature is also evident in Biber Deresi. In Türkiye and Greece, the Lower Palaeolithic is represented by two distinct technological elements. The initial structure is characterized by flake technology, produced from non-systematic cores and pebble core tools. This group is most often accompanied by groups of tools with denticulated and notched characteristics. This group reflects Mode 1 technology, as evidenced by its identification in stratigraphic excavations at Yarımburgaz Cave in Istanbul (400 kya) (Arsebük & Özbaşaran, 1999) and Dursunlu in Konya (1 Mya) (Güleç et al., 2009) in Türkiye. It is also well documented in Greece at the sites of Marathousa I in Megalopolis (500 kya) (Panagopoulou et al., 2018; De Caro et al., 2024) and Rodia in Heraklion (200–400 kya) (Runnels & Van Andel, 1993).

The second technological element is the Mode 2 technological structure, which encompasses large cutting tools such as handaxes, cleavers, and trihedral picks. In the Lower Palaeolithic of Türkiye, Mode 2 technology is accompanied by Mode 3 industries with prepared cores, such as the Levallois technique. These structures have been well documented in Türkiye in the excavation of Kaletepe Deresi 3 in Niğde (< 900 kya) (Slimak et al., 2008) and Gürgürbaba Hill in Van (310 kya) (Baykara et al., 2022). The Lower Palaeolithic assemblage from Karain Cave, one of Türkiye's long-term excavations, is characterized by the presence of retouched tools manufactured on thick flake blanks (Aydın, 2017). Additionally, there is a paucity of handaxes within the Karain assemblage. Stepped retouched scrapers made on thick blanks, such as those of the quina type (i.e. scrapers with a stepped or alternating retouch along the edge), are of note. It seems possible to posit a two-phase stratification of the Lower and Early Middle Palaeolithic, with an Acheulo-Yabrudian-like industry and a Tayacian industry (for a comprehensive overview, see Otte et al., 1998; Aydın, 2017).

In Greece, the Acheulean data are derived from Stelida in the Cyclades (250 kya) (Carter et al., 2017, 2019), Kokkinopolis in Epirus (220 kya) (Tourloukis et al., 2015), and Rodafnidia on Lesvos (160–470 kya) (Galanidou et al., 2016). Examples of Stelida handaxes and picks have been discovered on the surface rather than at excavation sites, which has resulted in uncertainty regarding their stratigraphic context. In contrast, Kokkinopolis handaxes have been linked to Micoquien and *Keilmesser* (backed cutting tool) technology, indicating an earlier Middle Palaeolithic technology rather than a Lower Palaeolithic industry. This is further supported by the available absolute dates from Kokkinopolis. This context suggests that the Biber Deresi assemblage may be less strongly indicative of a late Lower Palaeolithic—based on the trihedral pick—or alternatively more strongly indicative of an early Middle Palaeolithic.

Conclusion

Biber Deresi stands out as a pivotal site for understanding the Palaeolithic occupation along the Anatolian–Aegean border. Its extensive Lower–Middle Palaeolithic assemblage, combined with Acheulean elements, provides crucial insights into hominin mobility and adaptation in this transitional region. The lithic material is characterized by large cutting tools with handaxes, trihedral picks, and cleavers; pebble core tools with choppers and chopping tools; flake-based technology produced from unprepared and prepared cores, including the Levallois technique; and retouched tools. Together they underline the site's role as both a resource-rich environment and a potential corridor for early human movements between Asia and Europe.

The assemblage's context—distributed across erosion surfaces and alluvial deposits—highlights the dynamic interplay of tectonic and geomorphological processes that have influenced the preservation and visibility of the archaeological evidence. Despite these challenges, Biber Deresi represents a rare and rich Palaeolithic record on the Aegean coast of Türkiye, contributing significantly to the region's archaeological map.

This significance extends beyond the lithic assemblages, as Biber Deresi's geographical location offers vital insights into Pleistocene coastal dynamics and land–sea interactions. During periods of low sea levels, the site is likely to have formed part of a land bridge connecting Anatolia with Lesvos, the eastern Aegean islands, and the northern Greek mainland (Sakellariou & Galanidou, 2016, 2017). This would have facilitated not only hominin movement but also cultural and ecological exchange across the Aegean landscape. Such connections underscore the strategic importance of Biber Deresi in understanding early human dispersal and adaptations to changing coastal environments. Further research should prioritize detailed stratigraphic studies and absolute dating to refine the chronology and deepen our understanding of the cultural sequences present. Biber Deresi could then offer even more nuanced perspectives on the early human occupation of the region and its broader implications for Palaeolithic dispersals.

Supplementary Material

The supplementary material for this article can be found at http://doi.org/10.1017/eaa.2025.10.

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Biographical Notes

Göknur Karahan is an assistant professor in the Department of Archaeology-Prehistory at Hacettepe University, specializing in Palaeolithic archaeology. She completed her PhD at Ankara University with a focus on the Palaeolithic of the Northern Aegean. Her research interests include lithic technology, human mobility, and the Lower and Middle Palaeolithic of Anatolia, with a particular emphasis on interactions between Anatolia and the Aegean during the Palaeolithic, as well as hominin dispersals. Dr Karahan is actively involved in fieldwork at various Palaeolithic sites, including Karain Cave, and continues to participate in several national and international research projects.

Address: Department of Prehistory, Faculty of Letters, Hacettepe University, Ankara, Türkiye. [email: goknurkarahan@hacettepe.edu.tr]. ORCID: 0000-0002-0228-1702.

Nurettin Arslan is a professor in the Department of Archaeology at Çanakkale Onsekiz Mart University. His research focuses on classical archaeology, with extensive work in the field, particularly as the director of the Assos Excavations. Prof. Arslan has contributed to numerous archaeological projects and has published widely in the field of archaeology and art history.

Address: Department of Archaeology, Faculty of Humanities and Letters, Çanakkale Onsekiz Mart University, Çanakkale, Türkiye. [email: arslan@comu.edu.tr]. ORCID: 0000-0003-3227-3583.

Un site paléolithique clé reliant l'Anatolie à la Mer Égée : Biber Deresi, Assos

Biber Deresi est un site de plein air sur la côte de Çanakkale à Assos/Behram, associé à un système de rivières et de sources de matières premières. L'importance du site est due à la découverte d'un ensemble de matériel lithique du Paléolithique inferieur et moyen le plus étendu qu'on ait jamais identifié sur la côte égéenne de la Turquie. Ce matériel lithique est caractérisé par un nombre important de grands outils servant à tailler ou couper, notamment des bifaces, des hachereaux, des pointes trièdres et des outils formés sur des nucléus de galets représentés surtout par des « chopping tools ». Les éclats produits à partir de nucléus tant préparés que *non préparés prédominent. Il est évident que pendant la période de bas niveau de la mer au Pléistocène la région de Çanakkale était reliée à Lesbos et à le Grèce continentale via les îles égéennes orientales. Biber Deresi est donc un site clé qui a facilité le mouvement et la communication des homininés entre l'Asie et l'Europe et qui apporte de nouveaux éléments à la construction de la carte archéologique du Paléolithique dans le monde égéen.* Translation by Madeleine Hummler

Mots clés: monde égéen, Çanakkale, Assos, Paléolithique, Acheuléen, technologie lithique

Ein hochwichtiger paläolithischer Fundort als Brücke zwischen Anatolien und der Ägäis: Biber Deresi, Assos

Biber Deresi ist eine Stätte im Freigelände an der Küste von Çanakkale in Assos/Behram, die mit Flusssystemen und Rohstoffquellen verbunden ist. Die besondere Bedeutung des Fundortes liegt in der Entdeckung der umfangreichsten Sammlung von alt- und mittelpaläolithischem Material, das je an der türkischen Küste der Ägäis gemacht wurde. Charakteristisch für das lithische Material sind zahlreiche große Werkzeuge, die zum Schneiden verwendet wurden, darunter Faustkeile, Schneidewerkzeuge (oder Hacker), dreiflächige Spitzen und Werkzeuge, die Kerne von Kieselsteinen verwendeten, vor allem „chopping tools". Abschläge von sowohl unvorbereiteten wie vorbereiteten Kernen sind in der Mehrzahl. Offensichtlich war die Gegend von Çanakkale während der pleistozänen Zeit des niedrigen Meeresspiegels mit Lesbos und dem griechischen Festland via die östlichen Ägäis-Inseln verbunden. Biber Deresi gilt als ein sehr wichtiger Fundort, der die Bewegung und Verbindungen von Homininen zwischen Asien und Europa förderte und neue Angaben für die archäologische Karte des Paläolithikums in der Ägäis liefert. Translation by Madeleine Hummler

Stichworte: Ägäis, Çanakkale, Assos, Paläolithikum, Acheuléen, lithische Technologie