II. The Onset of Pressure Blade Making in Western Anatolia in the 7th Millennium BC: A Case Study from Neolithic Çukuriçi Höyük

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Abstract: Pressure blade making in the 7th millennium BC Çukuriçi Höyük is studied with an aim of bringing the lithic technology of a particular site in western Anatolia into the wider picture concerning the emergence of pressure technique in Anatolian Neolithic. Detailed analysis of lithic assemblages from Çukuriçi Höyük revealed information about different modes of pressure technique for blade detachment, which allowed us to propose the existence of certain levels of specialisation by local artisans, which could then be traced further east. Additionally, due to 'masses' of blades produced using the pressure technique, present on site, and the abundance of obsidian, which is in contrast to the raw materials of neighbouring sites, we presume that Çukuriçi Höyük, with its location directly on the coast of the Aegean Sea in prehistory, holds a unique place in 7th millennium BC in the region of Izmir, if not even beyond, in the Aegean world.

Keywords: pressure technique, blade(let)s, obsidian, Neolithic, 7th millennium BC, western Anatolia

Zusammenfassung: Die Forschungen zur Klingenproduktion mittels Drucktechnik auf dem Çukuriçi Höyük haben das Ziel, die lithischen Funde dieses Fundplatzes an der anatolischen Ägäisküste in einen überregionalen Kontext mit dem Aufkommen dieser Technologie im Neolithikum in Anatolien zu setzen. Detaillierte Studien des Lithikinventars erbrachten Informationen zu unterschiedlichen Arten der Drucktechnik. Diese ermöglichen es, unterschiedliche Grade der Spezialisierung der lokalen Handwerker anzunehmen, wie es auch von Fundstellen weiter im Osten bekannt ist. Aufgrund der großen Anzahl von in Drucktechnik hergestellten Klingen sowie des im Gegensatz zu benachbarten Fundstellen sehr häufigen Vorkommens von Obsidian, ist davon auszugehen, dass die Siedlung auf dem Çukuriçi Höyük im 7. Jahrtausend v. Chr. eine einzigartige Stellung in der Region Izmir, wenn nicht sogar der ägäischen Welt, einnimmt.

Stichworte: Drucktechnik, (Mikro)Klinge, Obsidian, Neolithikum, 7. Jahrtausend v. Chr., Westanatolien

The primary criteria for recognising pressure blade production, set out for the first time by Jaques Tixier in lithic assemblages of the Upper Capsian, an Epipaleolithic culture of the Maghreb, are parallel ridges, slight curvature of profiles, reduced thinness, the absence of any impact point and pronounced short bulb.[21] Furthermore, blades obtained by pressure reduction possess certain characteristics, mainly the striking regularity of finished product that would be impossible to achieve by percussion.

In the very beginning, in order to avoid possible terminological confusion, it is important to emphasise the difference between pressure retouch, which was already in use by Upper Paleolithic societies, most probably as early as the Solutrean, from the pressure technique in blade production.[22] The earliest evidence for micro-blade pressure debitage has been observed in Siberia, Mongolia, and Northern China, going back to ca. 20,000 BP, while discussions on the topic suggested that one of these regions can be the presupposed centre of origin for the pressure technique.[23] Nevertheless, one should not exclude the possibility of multiple separate centres. Aside from

21 Tixier 1984.
22 Inizan 2012, 20.
23 Inizan 2012, 22.

this early appearance, pressure blade making is found mostly in Neolithic contexts, regardless of the chronological differences on regional bases. Different synonyms are in use in reference to pressure blade making (or production). Some of these terms include pressure knapping, pressure debitage, pressure technology, pressure technique (for blade making), pressure reduction (of the core), pressure detachment, pressure fracture process, and pressure flaking.[24] Debitage in this context relates to the French term, associated with the blade detachment during the main blank production phase, as previously emphasised by M. Inizan.[25]

The phenomenon of pressure blade making raises several research questions concerning the origin and invention of the technique, and diffusion over vast territories in different periods of prehistory, as well as its appearance in new regions and adoption by various groups.[26] Such specific questions can be used to address the life ways, practices of prehistoric communities, and additionally point to mobility and migration. Therefore, certain analysis referring to lithic technologies can provide an outcome which goes far beyond the local level of the investigation of chipped stone assemblages. As it has already became clear in the studies of the earliest Paleolithic material, in general, analysis of lithic technology with its distinct production forms, rather than typology, offers the way of understanding particular human behaviours, and therefore can be applied directly to studies of 'how' and 'why' people were making stone tools in the past. Consequently, the results of typological analysis of western Anatolian lithic assemblages will not take place in this article. Rather, the focus will be on depicting the technology based on pressure blade making, using the Neolithic site of Çukuriçi Höyük as a case study for the micro region of Izmir. Additionally, research about raw materials, as a part of separate field of our investigation of western Anatolian lithics, will be mentioned only briefly in the following text.

Finally, this research focuses on the 7th millennium BC, the Neolithic in Anatolia, and ends with the appearance of Chalcolithic around 6,000 BC.[27] After more or less published lithic assemblages yielded information on Neolithic technology in south-eastern, central, and north-western Anatolia, the focus will be for the first time on the centre of the Aegean Anatolia, which is generally lacking in the investigation of lithics due to the recent and still ongoing excavations in the Izmir region.

II.1. Research Background

Translated historical records of Torquemada's *Monarquía Indiana* (1615), left after the Spanish Conquest of the Aztec Empire, brought to light the first description of blade-making accompanied by depictions of blades or 'razors' from 'fluted prism of obsidian'.[28] However, the first actual observation and recognition of the pressure technique was done by Don Crabtree in 1968,[29] with whom methodological research and pressure blade experimentation started. Indeed, many of the significant contributors who replicated pressure blades[30] were initially seeking to reproduce points and arrowheads.

24 All of the terms are strictly related to the process concerning the production of blade blanks. One should bear in mind the possible misinterpretation of the term 'pressure flaking', which is often used in the literature about the Anatolian Neolithic to address pressure retouch, due to the removal of little flakes while pressure retouching tools, especially arrowheads.

25 Inizan 2012: 11, 15.

26 The questions were already pointed out in the introduction of one of the recent studies on the topic by Desrosiers 2012b, the publication that has been one of the stimuli for writing this article.

27 E.g. Schoop 2005.

28 Clark 2012, 44–45.

29 Inizan 2012, 11.

30 For detailed study on main contributors experimenting with pressure blade making, see Clark 2012.

One of the most important contributions to modern stone knapping and the pressure technique is without doubt the identification of the 'knowledge' and 'know how' by Jaques Pelegrin.[31] His decades-long pioneering work gave insights into the existence of different modes of pressure knapping, including changing the body positions of the knapper, while dealing with different sizes of cores and methods of their immobilisation.[32] Pelegrin's work on lithics in Neolithic of Anatolia, and beyond, including Syria, Greece and Europe, suggested possible ways of obtaining extremely large blades by pressure reduction, made in both obsidian and flint.[33] Another important study by Philip Wilke, who replicated the series of pressure blades, focused on pressure reduction and immobilisation of small cores. His experimental research was based on patterns of bullet core assemblages of the Old World during the 10th and 9th millennia BC.[34]

Finally, comprehensive research on pressure blade making in Anatolia has been done as collaborative work between French and Turkish scholars, starting with Didier Binder, on the topic of the first pressure blade making in south-eastern and central Turkey, together with Nur Balkan-Atlı.[35] Analysis of pressure blades among lithics from south-eastern Anatolia, as part of so-called Upper Mesopotamian region, was the focus of research by Çiler Algül, Ferran Borrell and Laurence Astruc concerning transitional periods between the Pre-Pottery and Pottery Neolithic and further complexities of lithic assemblages.[36]

II.2. The Appearance of Pressure Blade Making in Anatolia

The first documented evidence for pressure blades and their production in eastern and central Anatolia comes from Pre-Pottery Neolithic contexts, before 7th millennium BC. Two 'centres'[37] of blade production using the pressure technique have been recognised in 9th millennium BC Anatolia from the work of D. Binder, who brought together the results of the appearance and evolution of pressure blade making.

Starting from Çayönü Tepesi in eastern Anatolia, which has been declared to be the key site for understanding the process of Neolithisation in the region,[38] the first pressure blade making has been documented in the Early PPNB, within the Channel building sub-phase, dated to ca. 8500–8250 calBC.[39] It seems that there was no earlier use of pressure technique in the previous PPNA period or in the transition from PPNA to PPNB.[40]

The evolution of the pressure technique at Çayönü Tepesi was fast. Appearing in the EPPNB, pressure blades were limited to very small sizes, particularly in terms of their width. Knapping was conducted on both obsidian and flint, with the flint probably not heat-treated. Slightly wider blades were obtained only from obsidian. The available data suggests mainly production of micro-bladelets (with width 4–8.5mm) from semi-conical or conical cores in the EPPNB, and possible use of copper-tipped pressure tools.[41] The number of pressure blades increases through phases, and in following MPPNB and LPPNB periods, the trend of making pressure blades became the

31 Pelegrin 1990 (as already noted in Clark 2012, 43).
32 Pelegrin 2012.
33 Pelegrin in Perlès 2004, 39; Pelegrin 2006; Astruc et al. 2007; Altınbilek-Algül et al. 2012.
34 Wilke 1996.
35 E.g. Binder 2007; Binder – Balkan-Atlı 2001; Balkan-Atlı – Binder 2012.
36 Algül 2008; Astruc 2011; Borrell 2011; Altınbilek-Algül et al. 2012. One of the most recent studies dealing with the topic of pressure technique, with two case studies from Çatalhöyük and Akarçay, is the unpublished PhD thesis by N. Kayacan (Kayacan 2015).
37 Meaning of 'centres' here has to do with two locations where pressure technique was documented in the same time approximately, but the origin seems to be single.
38 E.g. Erim-Özdoğan 2011.
39 Binder 2007, 240.
40 Binder 2007; Altınbilek-Algül et al. 2012.
41 Binder 2007, 241.

production of bladelets (with the width of 8.5–13mm), possibly due to the increased quantity of obsidian at the settlement. There is a general lack of micro-bladelets in later phases, which were previously present in the assemblages of the EPPNB. Heat-treatment of flint seems to be introduced at this time. The blade production, i.e. debitage was of frontal type, where blades were detached from flat inclined platforms, becoming wider and more regular in shape.[42] The standardisation and regularity of blade widths gradually led to the production of large and extremely wide blade products detached by pressure using a lever in the end of Pre-Pottery Neolithic, marked by transition from 8th to 7th millennium BC, somewhere between 7340 and 7080 calBC.[43]

A slightly different situation has been observed on Cappadocian lithics, where several tons of waste material associated with the first stages of roughing and shaping out preforms has been found without actual blade products. Two obsidian workshops, Kayırlı and Kaletepe Kömürcü, situated on the borders of the Göllü Dağ outcrop and dating to the second half of 9th millennium BC, testify to the earliest presence of pressure débitage in central Anatolia.[44] However, the Kaletepe workshop, which was probably used seasonally, and only for several hundred years, yielded the most important information about specialised pressure blade making and contacts with other regions in the 9th millennium BC.

In area P, within Kaletepe-Kömürcü, two types of highly specialised blade productions have been documented, focusing on bi-directional (naviform) and prismatic cores with frontal débitage. The production by pressure technique, starting on bifacial pre-cores with a flat inclined platform, had an aim of producing bladelets longer than 7.5cm. After producing around 50–60 bladelets of standardised sizes from each core, the core was abandoned without further reshaping.[45] The production was obviously designed for one purpose – the distribution of regular obsidian blades out of Cappadocia. In different PPNB contexts, such as Cyprus and the Levant, the presence of Kaletepe products is attested through the specific shape of blades and obsidian provenance. Nevertheless, evidence of very early Göllü Dağ obsidian, diffused as prismatic blades in the EPPNB of Shillourokambos,[46] Dja'de III[47] and Mureybet IV[48] testify about earlier activation of Kaletepe workshop, which goes back to the end of the first half of the 9th millennium BC.[49]

While the assemblage of blades with uniform widths and indications of a repetitive knapping rhythm (sequence 212') imply a process of precise blade production conducted in the seated position[50] for the Kaletepe workshop, pressure blade making at Çayönü Tepesi during the same period was of bimodal character, i.e. blades were produced by hand pressure and in a seated position with a crutch, with regularity of knapping rhythm only in LPPNB.[51] The nature of Kaletepe blade production therefore can be seen as very specialised, both due to the knapping features and distribution of blades beyond the workshop.

Use of the Cappadocian workshops seems to fade away with the emergence of the Aşıklı-Musular-Çatalhöyük complex in the beginning of the 8th millennium, where no pressure technique in blade making was found.[52] In the meantime, however, pressure technique was preserved in the south-eastern region of Anatolia. Pressure blade making at Akarçay,[53] in the region of Urfa, defined by pressure blades made on single-platform prismatic/pyramidal and flat cores, according to

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42 Binder 2007, 242–243.
43 Binder 2007; Altınbilek-Algül et al. 2012, 173.
44 Binder – Balkan-Atlı 2001; Binder 2007; Balkan-Atlı – Binder 2012.
45 Balkan-Atlı – Binder 2012, 75.
46 Briois et al. 1997.
47 Coqueugniot 2000.
48 Cauvin 1998.
49 Binder 2007, 244.
50 For patterns of different blade widths according to modes of pressure technique and knappers' positions, see Pelegrin 2012.
51 Binder 2007, 243–245.
52 Binder 2007, 239.
53 For further information on chipped stone industry of the site, see Borrell 2011.

F. Borrell (2011), represents the first evidence of the diffusion of technology from sites as Cafer Höyük or Çayönü from the east to the northern part of the middle Euphrates valley during the mid-8th millennium BC. The spreading of technique is seen in the entire micro-region, visible at the sites of Hayaz Höyük, Gritille, and Mezraa-Teleilat.[54]

II.3. 'News from the West' – The Neolithic site of Çukuriçi Höyük

Çukuriçi Höyük had a specific location in prehistory, with the direct access to the Aegean Sea, as evidenced after the reconstruction of the coastline.[55] The occupation of the settlement covers the time span from the Early Neolithic to Early Bronze Age period, i.e. from 7th to 3rd millennia BC.[56] The lithic analysis in the following text is based on the examination of chipped stone assemblages of the Late Neolithic phases ÇuHö X–VIII, while the earliest occupation of the settlement is briefly addressed in order to trace the initial appearance of pressure blade making at the site.

As published earlier, fish remains together with a remarkably high percentage of imported, i.e. exotic obsidian indicate intensive use of the Aegean Sea in Neolithic Çukuriçi Höyük.[57] First investigations of lithics from the site showed that obsidian was the primary raw material for making stone tools. It seems that the abundance of obsidian is continuous during the whole occupation of the site. Regarding the first Neutron Activation Analysis (NAA) done for 64 Early Bronze Age and Chalcolithic samples, the majority of obsidian specimens come from the Cycladic island of Melos, with only three samples assigned to central Anatolian sources.[58] Recently sampled specimens from Neolithic levels at Çukuriçi Höyük, within the same method of NAA supported the hypothesised dominance of Melian obsidian in Neolithic contexts.[59] The preliminary results of ongoing studies on sourcing non-obsidian raw materials in the region of Izmir demonstrated that different types of locally available cherts, with less frequent jasper and chalcedony, were used for tool production in Neolithic Çukuriçi Höyük.[60] The average observed ratio between obsidian and chert at the site is 85% to 15%.

Lithic assemblages of Late Neolithic Çukuriçi show continuity in terms of raw material used for chipped stone artefacts, and common technological and typological features. Products connected with platform and knapping surface preparation, together with different types of thick and thin flakes are evidence of on-site knapping, rather than importing finished tools. Although workshops are not yet documented in situ within the excavated part of the settlement, several open areas may be the locations used for knapping outside of domestic contexts.

Aside from the majority of unused blades, made of both obsidian and chert, retouched tools are present in relatively low amounts on the site. Among the retouched tools, various kinds of retouched blades, such as truncations, denticulates and notches have been identified. In addition, end-scrapers on blades and flakes, drills and perforators, along with a small amount of recognisable chert sickle elements are present. There is a general lack of burins at Çukuriçi. Finally, a specific repertoire of circular and semi-circular scrapers, made on flat flakes, characterise Late Neolithic phases of Çukuriçi Höyük.

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54 Borrell 2011, 217.

55 Stock et al. 2013, 2, fig. 1.

56 For detailed stratigraphy and chronology of the settlement, see chapter I.2 in this volume. Previous publications concerning the settlement's chronology are Horejs et al. 2011; Galik – Horejs 2011; Horejs 2012; Horejs 2016.

57 Horejs 2016, 155–156.

58 Bergner et al. 2009.

59 Neutron Activation Analysis was conducted by E. Pernicka in the laboratory in Mannheim, e.g. Horejs – Milić 2013.

60 The sourcing of non-obsidian raw materials in the vicinity of Çukuriçi Höyük and the determination of chert groups within chipped stone assemblages from different Neolithic sites in Izmir region is a sub-project coordinated by M. Brandl and M. Martinez, with the assistance of B. Milić.

II.4. Pressure Blade Making at Çukuriçi Höyük

Neolithic pressure blade making at Çukuriçi Höyük has been recognised on sets of obsidian blades, marked by the striking parallelism of ridges, relative thinness, slightly curvature of profiles and small, slightly pronounced bulbs. Cores in both obsidian and chert were found in different stages of exploitation, showing the negatives of detachment of regular blades.

Even though the study of lithic material from Neolithic phases is still in progress, the results regarding the approximate on-site proportions of blades from ÇuHö X–VIII detached by pressure knapping versus percussion can be outlined. Around 60% of obsidian and 40% of chert blades can be securely assigned to pressure technique, while indirect percussion seems to have a quite minor role in the reduction systems of Çukuriçi Höyük (approx. 1–3%). However, there is still quite a large number of blades and bladelets which cannot be securely determined concerning the knapping technique. Within the obsidian and chert groups of blades, the rest of approximately 40% and 60% of blades respectively can fit into both pressure technique and direct percussion, due to the slightly regular ridges. Most of those undetermined blades are preserved in medial fragments, which additionally makes recognition difficult due to the lack of butts, i.e. platforms which is the most useful criteria in determining the knapping technique.

The entire Neolithic assemblage at Çukuriçi is comprised of approximately 18.000 single lithic pieces, coming from all phases of stone tool production on site. The following chart provides an insight into the overall proportions of artefacts related to the main categories recognised within the technological analysis in Late Neolithic phases X–VIII (Fig. 2.1). According to the analysis of two different raw materials, blades in obsidian were clearly the aim of lithic production at the settlement, while the high presence of chert flakes can attest a different production, with a general tendency towards blade making observed.

In order to present the appearance and development of the pressure technique from Neolithic phases here, we would be following features defining pressure blade making suggested by Pelegrin, concerning the particular modes of force application, visible in dimensions of blade products, platform preparation and detachment stigmata, as well as the method of core shaping and reduction sequences.[61] Additionally, we expect to define possible preforms of the cores, together with the way of holding or immobilising the cores during the process of blade detachment.

Experimental research on 'modes'[62] of pressure showed that there are differences in the maximum widths of obsidian and flint that can be reached by pressure detachment supported by certain body position, depending on nature of raw material used.[63] The smallest blade specimens within Neolithic Çukuriçi have width range from 3mm to 8mm in both chert and obsidian, and represent pressure production with the aim of obtaining micro-blades by holding the core in hand. Pressure detachment using a shoulder crutch, while keeping the core in the hand, results in wider blades,[64] i.e. bladelets with width between 8–10mm in chert, or maximum 12mm for obsidian in ÇuHö X–VIII. An improved method, placing core on the ground while the knapper detaches blades in a sitting position, allows greater force to be applied and produces wider, more regular blades.[65] Chert blades 10–12mm in width and obsidian blades around 12–13mm wide produced using this mode have been observed in ÇuHö X–VIII. Finally, presumably longer blades with widths between 12–20mm for chert and 16–26mm for obsidian could be suggested if pressure was applied in a standing position, with the core immobilised on the ground, wherein the whole body weight is used for pressure force.

[61] Pelegrin 2012, 496.
[62] In further text, the definition of pressure modes for Çukuriçi blade making follows the width sizes suggested by Pelegrin 2012, 480 fig. 18.12.
[63] Pelegrin 2012, 468–483.
[64] Pelegrin 2012, 469–470.
[65] Pelegrin 2012, 470–475.

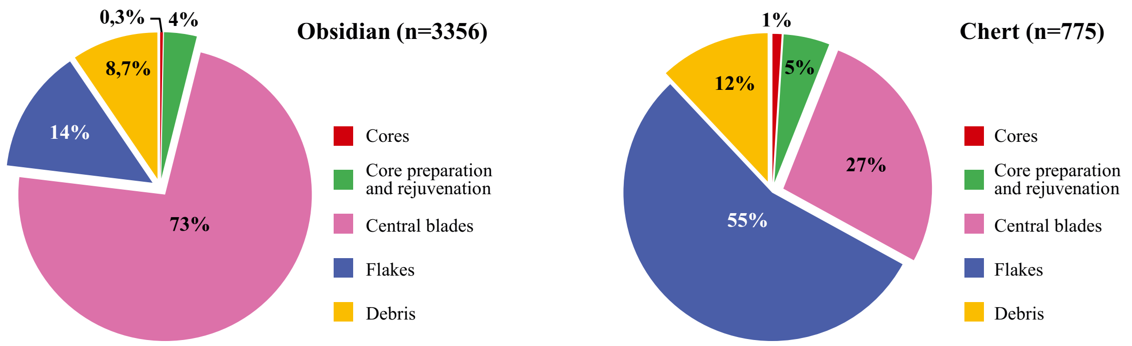

Fig. 2.1 The representation of the main categories regarding the technological analysis of lithics from phases ÇuHö X–VIII (n=4131) (graphics: B. Milić)

Among the assemblages of ÇuHö X–VIII, the majority of obsidian pressure blades are in the width range between 10–14mm, directly followed by widths between 13–16mm. No heat-treatment of locally available cherts has been confirmed so far. However, the less frequent chert blades seem to be mostly in widths between 8–10mm (Fig. 2.2). The first results based on dimensional limits, widths in particular, showed that the most commonly practiced mode in Neolithic context at Çukuriçi Höyük was sitting pressure. Bladelets and blades produced by hand pressure using a crutch and standing pressure are present in comparable frequencies in ÇuHö X–VIII. Tiny micro-blades are present in lowest quantities, compared to wider blades, and it appears that chert is used more than obsidian in micro-blade production. Due to the regular sieving activities on site, the smallest micro-blades with widths from 2–5mm and lengths around 20mm have been found.

Thin, plain butts of pressure blades and bladelets from Neolithic Çukuriçi with an angle around 80–90°, suggest blade detachment from flat and orthogonal platforms, which were completely

Fig. 2.2 Pressure bladelets obtained by using modes 2 and 3 (hand pressure with a crutch and sitting pressure, photo: N. Gail/ÖAI)

prepared prior to pressure being applied. We suppose that the opening of platform occurred by removal of single thick flake, leaving behind the planar surface, which has been additionally prepared by abrasion and grinding, especially in case of obsidian, in order to avoid slipping in débitage.[66] L. Astruc previously noticed on obsidian from Sabi Abyad that abrasion was probably done with the side of a fine-grained soft stone, leaving micro-scalar retouch on edges of platform.[67] This fits perfectly in the case of platform preparation at Çukuriçi. The thickness of butts between 1mm and 2mm, the absence of impact point or crack, and occasional presence of small lip suggest an organic pressure tool point in detachment,[68] possibly the use of antler. Wooden material for the tip of a pressure tool would require a wider platform surface to achieve sufficient contact, resulting in wide butts, and therefore is unlikely here. Copper tips, already suggested for the detachment of blades in the PPN at Çayönü Tepesi,[69] leave a specific circular crack on the platform[70] and can be completely excluded in the case of Neolithic Çukuriçi, since there are no real copper products in Neolithic period of western Anatolia documented so far.[71] Finally, the platform seems to be completely prepared before the detachments started, rather than worked on after detachment of each blade. However, removing of traces caused by applied force of pressure during the process of débitage is documented by removal of the overhangs done by smoothing the edges of platform. Finally, platform was rarely slightly convex, as some less regular conical chert cores may demonstrate.

Pressure blade making was carried out on conical, semi-conical, and very rarely cylindrical and flat cores. The complete and precise reduction of the first two types led to the shape of bullet cores, documented in both obsidian and chert during the Neolithic of Çukuriçi Höyük. However, cores in different stages of exploitation have been attested.[72] As P. Wilke pointed out in his broad study about bullet cores, preforms of such cores may vary, and it is quite difficult to determine the precise shape in the first stage of preparation.[73] Nevertheless, several features found on available cores from Çukuriçi suggest preforms starting with one or two crests, initially shaped by bifacial flaking or percussion with detailed care in maintaining the size of the core. Blade making on-site is documented in the Late Neolithic contexts at the settlement, as previously demonstrated, yet in the case of obsidian, the waste material connected with roughing out and shaping the performs is lacking. Since the obsidian originated from a place c. 300km away from the settlement by the sea, this situation is not strange, due to the means of transport and carrying chunks of the raw material. It seems that careful shaping of preforms occurred at the source itself, with raw material brought to the settlement in the form of prepared cores or bigger blanks. It is important to emphasise that the preparation of a pressure blade core plays a rather decisive role in further blade detachment, and must have been done by person(s) already specialised in pressure techniques.[74] Once blanks were in settlement, the pressure blade making began with the preparation of a platform and removal of lateral blades.

During the knapping process, renewing the platform (Fig. 2.3c) or correcting the knapping surface took place in order to maintain the regularity of core reduction. Mistakes in central blade detachment occasionally led to the loss of working angle, whereas regaining an effective shape of knapping face has been done by making an additional crest.[75] Evidence for both of those cor-

66 Suggested by Inizan et al. 1999, 79.
67 Astruc et al. 2007, 6.
68 After Chabot – Pelegrin 2012, 185.
69 Binder 2007, 241.
70 Chabot – Pelegrin 2012; Pelegrin 2012.
71 Artefacts made of copper oxides – malachite or azurite – should be differentiated from the real copper finds.
72 So far, around 70 cores have been documented from Neolithic Çukuriçi Höyük. However, the biggest number is coming from the phases ÇuHö X–VIII with 56 cores recorded in both raw materials.
73 Wilke 1996.
74 Wilke 1996; Astruc et al. 2007; Inizan 2012.
75 After Wilke 1996, 302.

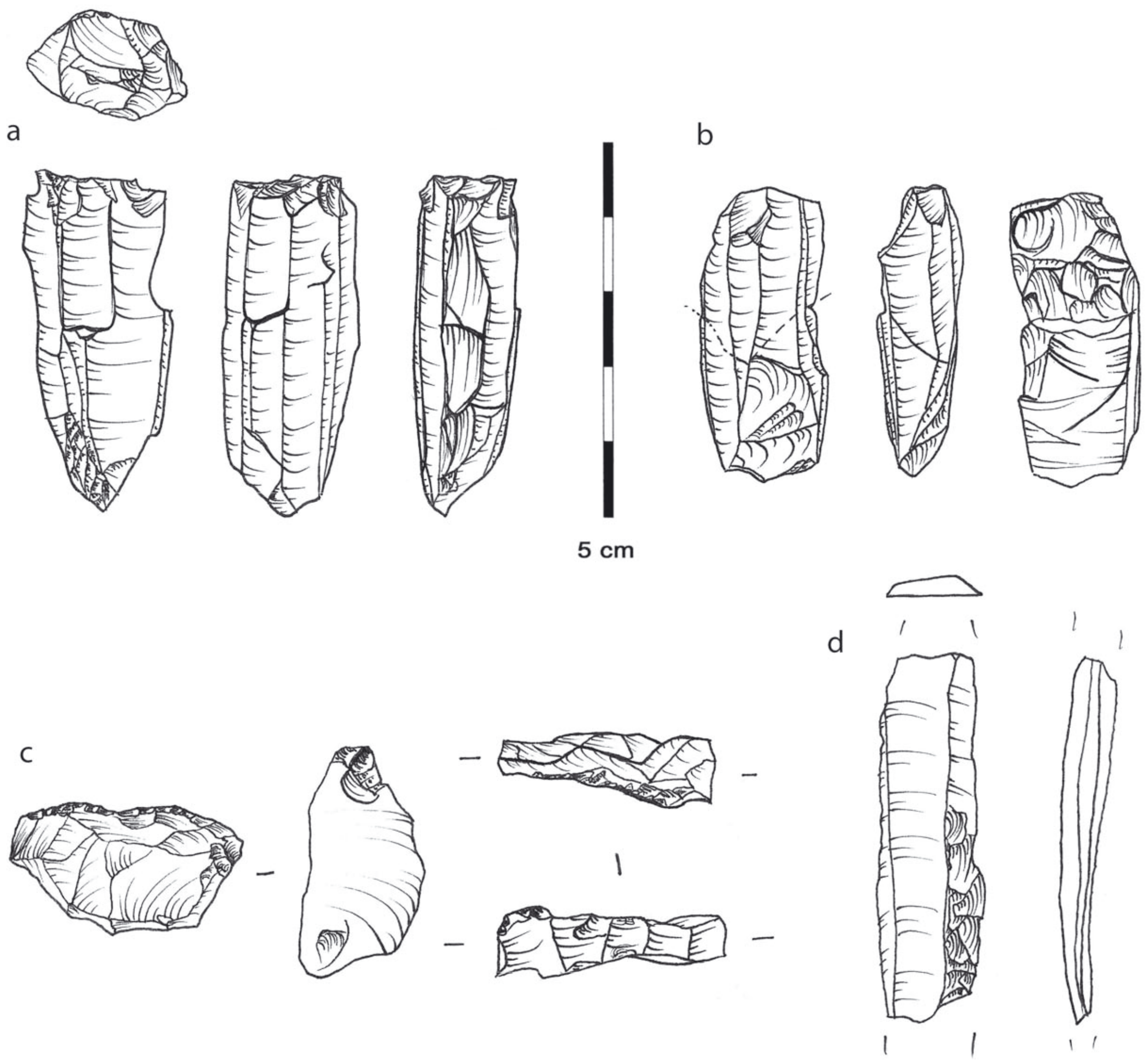

Fig. 2.3 Obsidian material related to core reduction: unidirectional blade core with a crest (a), broken blade core (b), tablet (c), secondarily crested blade (d) (graphics: B. Milić)

rections are detected on cores (Fig. 2.3a) and partially crested blades (Fig. 2.3d). Very rare hinged accidents visible on cores, and overshoots indicated by plunging blades that have removed the bottom of the core have been confirmed. However, random knapping failures, due to irregularities or impurities in raw material from ÇuHö X–VIII could have even resulted in complete core abandonment (Fig. 2.3b).

Knapping rhythms with both consecutive and non-consecutive detachment have been observed, with suggested repetition of sequence 212' testifying the systematic order of detachment in various assemblages. Despite the majority of blade with three facets, less frequent are blades with two facets and those micro-blades based on four facets, which are common for pressure débitage of small cores leading to bullet shapes. However, more investigation is needed to determine whether precise blade detachment relied on a standardised knapping rhythm at Çukuriçi Höyük, as has been attested for instance in EPPNB at Kaletepe-Kömürcu or LPPNB at Çayönü.[76]

[76] Binder 2007.

Fig. 2.4 Cores with notched distal ends (a–b)
due to immobilisation resulting in trapezoidal distal section on bladelets (c) (photos: N. Gail/ÖAI)

Along with suggested pressure modes, the immobilisation of cores in slotted blocks of bones[77] for holding cores in hand or grooved devices[78] for cores positioned on the ground can be suggested in case of Çukuriçi Höyük. The absence of pointed end on bladelets, and visible truncated distal ends on cores, consequences of amount of force applied, support the hypothesis of core immobilisation in particular devices. This method would also facilitate the production of blades with trapezoidal sections on both medial and distal parts (Fig. 2.4). According to Wilke, once cores reach very small dimension due to precise reduction, and cannot be truncated in the device for immobilisation, one may presume that blade detachment is finished and core is exhausted.[79]

Besides cores in conical or semi-conical and bullet shapes at ÇuHö X–VIII (Fig. 2.5a, b), a core with orthogonal platform and posterior crest may indicate a different kind of pressure blade technique at Çukuriçi Höyük (Fig. 2.5c, d). Namely, for the first time in phase X pressure débitage is becoming more or less frontal, based on a posterior crest. Such a crest, occupying the entire back side of the core, has clearly different character from the crests made during the main knapping phase in relation to core shape correction. A similar type of core with frontal débitage, often with inclined platform towards the posterior crest, also called wedge-shaped core, has marked a trend of blade detachment in PPN and PN in south-eastern Anatolia and the Northern Levant.[80] It is unclear whether knappers of Çukuriçi started producing such cores as a part of the experimentation of technique, or the further connections with different groups can be implied. However, the use of wedge-shaped cores at Çukuriçi can be clearly divided from the regular reduction of conical cores leading to bullet shape.

Finally, within house complex 10 from phase ÇuHö X, a cache of complete, long obsidian pressure blades, with the maximum length of 160mm has been found in situ. Additionally, four divided, slightly shorter, and fragmented long blades, 145mm for longest among them, have been documented during the excavation of the same house, but in different using horizons or floors of

[77] Wilke 1996.
[78] Pelegrin 2012.
[79] Wilke 1996.
[80] For the details about characteristics in production and distribution of wedge-shaped cores in relation with obsidian raw material see Maeda 2009.

Fig. 2.5 Semi-conical (a) and bullet core (b). Core with a posterior crest and possible frontal débitage (c–d) (photos: N. Gail/ÖAI)

the building. As content of the cache is part of separate study,[81] we would like to draw attention here to the possible level of specialisation in pressure blade making at Çukuriçi Höyük based on production of long blades on the one hand and wide blades on the other.

Within the house 10, two of four disconnected long blades appear to be very slender, while another two (Fig. 2.6) reach maximum width of 19mm and 21mm. Even though the widths still address the practice of standing pressure in blade detachment, carefully prepared platforms, removing of overhangs, and maintaining the lengths of these blades can speak in favour of specialisation of local knappers in the settlement.

Fig. 2.6 Long obsidian pressure blades from house complex 10, phase ÇuHö X (photos: N. Gail/ÖAI)

81 Horejs et al. 2015, 316–319.

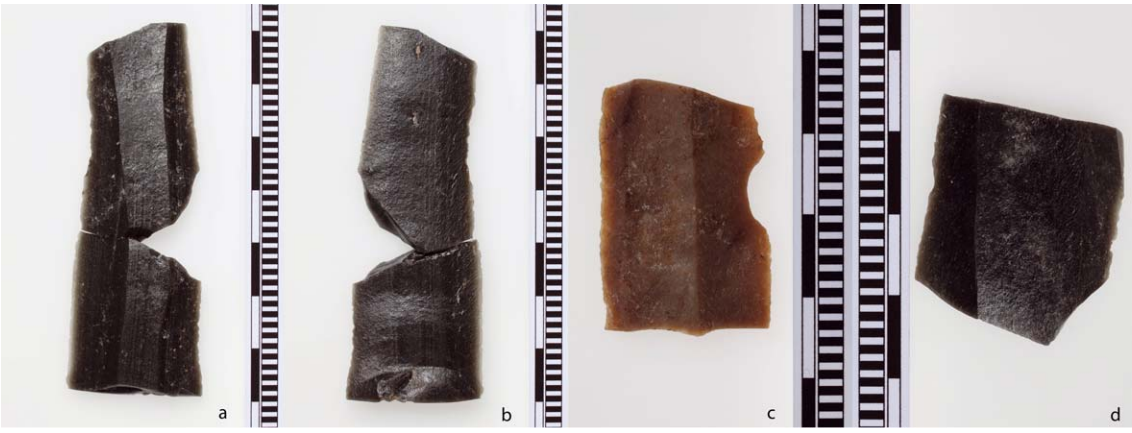

Fig. 2.7 The widest pressure blades of Neolithic Çukuriçi Höyük in obsidian and chert, phase ÇuHö VIII (photos: N. Gail/ÖAI)

The widest regular blades documented in Neolithic levels of Çukuriçi so far, related to the latest Neolithic phase ÇuHö VIII, range from 23–27mm for obsidian and 20–22mm for chert (Fig. 2.7). Maximum widths observed here, on both obsidian and chert, represent the boundary between standing pressure and the lever pressure technique,[82] which can detach extremely long and wide blades.[83] Unfortunately, the widest blades from Çukuriçi are available only in medial fragments, while detachment stigmata, visible on proximal parts visible on the platform rests, i.e. on butts, would be necessary to fully confirm the hypothesis of pressure detachment using lever. However, the possibility of introducing lever pressure to Neolithic Çukuriçi is not excluded, since according to Pelegrin, blades wider than 26mm for obsidian and 20mm for flint, which do occur at Çukuriçi, are too wide to be attained by application of any other technique.[84]

Although the previous part of the text was focused on the late Neolithic phases of Çukuriçi Höyük, it is important to emphasise that pressure blade making was attested at Çukuriçi Höyük from the earliest Neolithic phase XIII, referring to the foundation level of the settlement.[85] Due to the small recovered assemblage, no further information about pressure blade cores are available, however, the most of features already mentioned for the blades of phases X–VIII are recognised in the phase XIII as well. Most of the pressure blades in both raw materials are rather small in sizes, nevertheless, according to the preserved widths of obsidian regular blades, sitting and standing pressure can be suggested in blade production besides the rather common simple form of bladelet production by hand pressure. To sum up, pressure technique at Çukuriçi has been introduced from the beginning of the settlement - dated to the first part of the 7th mill. BC until the beginning of the 6th millennium, with a tendency towards the specialisation in blade making from the beginning until the end of the Neolithic period at the site.

II.5. Aspects of Regional Integrity – Dealing with Unpublished Data Sets from Neolithic Sites of the Izmir Region

The status of Neolithic occupation in Izmir region, situated on the centre of the western Anatolian coast, was unknown until the mid-1990s. Excavations at Ulucak, Yeşilova, and Ege Gübre, settled

82 After Pelegrin 2012, 480, fig. 18.1.
83 Pelegrin 2006; Altınbilek-Algül et al. 2012; Chabot – Pelegrin 2012.
84 Pelegrin 2012, 477–483.
85 Horejs et al. 2015, 306–308.

in 7th millennium BC, have yielded information about Neolithic way of life in the region, partially putting analysis of lithic data sets aside.

Except for a single study on lithics from Dedecik Heybelitepe, which seems to fit rather to the transitional period from the 7th to 6th millennium BC,[86] only occasional documentation of chipped stone artefacts from other sites in the region is available. Similarly, aside from obsidian blades at Dedecik Heybelitepe,[87] defined as extremely regular and detached from unidirectional blade cores,[88] no recognition of pressure blade making has been documented in the region. One may observe that publications including lithic material as a part of broader studies of the Neolithic have mostly concentrated on brief descriptions of typological features of stone tools, while the particular interest was on the presence of obsidian, as an exotic material amongst locally used flint or chert. However, based on scarcely published lithics and reported figures representing chipped stone tools, some preliminary observations on aspects of technology can be made.

Starting from Ulucak Höyük, information about lithics from level V and IV[89] is available. Due to the radiocarbon dates, Ulucak levels Vf–a, dated roughly to 6400–6000 calBC[90] fit into the second half of the 7th millennium and therefore can be compared with the previously presented Late Neolithic Çukuriçi phases X–VIII.[91] However, it has been recognised that during the time span from 6500–5800 BC, covering both levels V and later IV from Ulucak, lithic material, based on a lot of chert and less obsidian, is characterised by a blade production technology.[92] Despite an earlier proposal that obsidian from Ulucak was entirely Cappadocian, new NAA and XRF analysis demonstrate a Melian provenance and refute previous assumptions.[93] Further, flint and obsidian unidirectional and multidirectional flake and blade cores were found in levels V and IV, together with blades, blade segments, bladelets, sickle blades, and different types of retouched tools, representing 20–40% of the entire assemblage.[94] Even though preferable detachment of blades from prismatic blade cores is mentioned by the authors, it is suggested that flake blanks are much more frequent than blade blanks in both levels.[95] There is as yet no publication of detailed lithic features from the earliest excavated level VI at Ulucak Höyük, dated to the first half of the 7th millennium BC according to short-lived samples.[96] However, according to the preliminary results, the earliest Ulucak VI level is marked by the flake-based industry,[97] while obsidian is extremely low in quantities.[98] To conclude, initially unrecognised pressure blade making from level IV, clearly visible in drawings within first publications, can be applied to the material of Neolithic level V without doubts, due to the continuity of core shapes and abundance of regular blades. The beginning of pressure blade making probably relates to phase V, due to the lack of the technique in the earliest settlement occupation phase.

86 Herling et al. 2008; Lichter – Meriç 2012.
87 Obsidian covers two thirds of the lithic assemblages at Dedecik Heybelitepe (Lichter – Meriç 2012, 135).
88 Herling et al. 2008.
89 Initial publications of lithics from Ulucak IV, which was the earliest level known at the time of publication, drew attention to the presence of obsidian and high percentage of sickle blades (Çilingiroğlu et al. 2004, 52). However, pressure bladelets and tiny bullet cores and their fragments visible on Çilingiroğlu et al. 2004, figs. 38 and 39, have not been recognised, and were further typologically incorrectly determined.
90 Çilingiroğlu et al. 2012, 141.
91 Weninger et al. 2014; see chapter I in this volume.
92 Çilingiroğlu 2009, 13.
93 Çilingiroğlu et al. 2012, 148; Milić 2014.
94 Çilingiroğlu et al. 2012, 164, figs. 12–13.
95 Çilingiroğlu et al. 2012, 148.
96 The first suggested dates between 7050–6640 calBC, based on charcoal samples, have been abandoned in favour of AMS results, presenting a more coherent picture with shorter ranges. Regarding the new results, the founding of the earliest settlement at Ulucak has been proposed for 6760–6600 calBC (Çilingiroğlu 2011; Çilingiroğlu et al, 2012, 152–153; Weninger et al. 2014, 17).
97 Çevik – Abay 2016, 190.
98 Çilingiroğlu et al. 2012, 149.

Published lithics from Neolithic site of Yeşilova Höyük has revealed information based on solely typological features of chipped stone tools. According to the author, the first occupation of the site, in level III-8, may have happened some 200 years prior to radiocarbon-dated level III, dated to mid-7th millennium BC.[99] Due to the lack of lithic analysis, available data refer to the presence of obsidian and flint as raw material in making different tools, such as blades, knives, scrapers, piercers, borers and weapons. On-site knapping is suggested for Neolithic period based on the presence of cores and chips.[100] Nevertheless, examination of published images of lithic repertoire from Yeşilova suggests lithic technology connected with blade making. Published images and drawings of bladelets[101] clearly demonstrate the regularity of edges corresponding to pressure detachment. Proximal fragments of blades and bladelets of various widths, present in obsidian and dark and light flint, available on published photographs[102] attest to the presence of pressure débitage in level III. According to scale on the published photographs, there are a few blade fragments with very large widths between 20–22mm, but it is not clear whether the material is dark chert or obsidian.[103] A second image within the same publication, representing flint and obsidian cores and core fragments[104] once again indicates pressure blade making, detached from mainly conical cores. The micro-scalar retouches on the edge of the platform speaks in favour of platform preparation in advance by trimming the edge, while the notched distal ends on few cores imply core immobilisation.

The final two centuries of the 7th millennium marked the Neolithic occupation at Ege Gübre IV, a settlement located in volcanic terrain.[105] Though briefly documented, the stone industry, which was mostly reliant on flint procured from local sources, consisted of blades. The presence of a considerable number of cores and unretouched flakes, according to the author, indicates stone tool production on site.[106] Two publication photos,[107] demonstrating quite regular blades made of flint and chert, and conical cores in different sizes with negatives of regular blade detachments, suggest pressure blade making at Neolithic Ege Gübre, with no further detailed information available.

To sum up, it seems that pressure blade making can be attested at all Neolithic sites in the Izmir region, but further investigation is needed in order to get results concerning the degree of pressure débitage within the assemblages and its initial appearance.

II.6. Pressure Technique for Blade Making in Anatolia during the 7th Millennium BC

Lithic studies of the Neolithic period in central, north-western, and in lesser degree south-western Anatolia yielded the information about lithic technologies and the appearance of pressure techniques on sites from the 7th millennium BC. In this section, we would like to briefly point out the main locations where pressure blade making occurs in the Neolithic, in order to get an overview of the evolution of this technique in the broader area.

The gap marked by lack of pressure débitage in central Anatolia after termination of the Cappadocian obsidian workshops at the beginning of the 8th millennium BC ended with the appearance of pressure blade making in the beginning of the second half of the 7th millennium BC at Çatalhöyük VIB.[108] The transformation from percussion to pressure blade making should not be

[99] Derin 2012,183.
[100] Derin 2011, 99; Derin 2012, 182.
[101] Derin 2011, 102, fig. 10.
[102] Derin 2012, 192, fig. 16.
[103] Obsidian from Melos can be extremely mat and it is possible to confuse it with very dark flint, which is common at Yeşilova, especially by looking only at photographs.
[104] Derin 2012, 193, fig. 17.
[105] Sağlamtimur 2011; Sağlamtimur 2012.
[106] Sağlamtimur 2012, 200.
[107] Sağlamtimur 2012, 224–245, figs. 30, 31.
[108] Conolly 1999.

seen only as a rapid change within the lithic industry, as J. Conolly suggested, but has rather more to do with complexity based on the relationship between raw material and specific knapping traditions.[109] Raw material choice, from commonly used Göllü Dağ obsidian up to level VII shifting to Nenezi Dağ obsidian appears to happen simultaneously with the introduction of pressure blade detachment from unipolar prismatic blades.[110] The occurrence of small numbers of pressure-made blades made of Bingöl and Nemrut Dağ obsidian, from eastern Anatolian outcrops, and the presence of local versions of Çayönü tools at Çatalhöyük in the 7th millennium, may be hints for defining the origin of pressure blade making in the central Anatolian settlement. As pointed out, skilled pressure technique was adopted from south-eastern Anatolia and/or the northern Levant, as a consequence of contacts with communities in those regions.[111]

Pressure débitage in north-western Anatolia has been recognised within various sites or groups of sites during the Neolithic. However, discovery of lithics from 'pre-Neolithic' sequences after surveying the coastal terraces of the Black Sea and around Çanakkale and Balıkesir suggested the possible presence of Mesolithic/Epipaleolithic and Aceramic Neolithic periods in the region.[112] The possibility of such an early pressure technique was raised after the affiliation of certain cores similar in shape to bullet cores from the Ağaçlı group of sites (Ağaçlı, Domalı and Gümüşdere) to pressure and punch techniques.[113] Besides small cores, specific tool types fitting to the Mesolithic/Epipaleolithic tradition from the Black Sea terraces helped the determination of the surveyed material in certain periods.[114] A second survey at Çalca, in Çanakkale province and Musluçeşme, near Balıkesir, yielded another interesting lithic assemblage, possibly belonging to an Aceramic Neolithic period. The small amount of obsidian micro-blade cores and bladelets with regular shape found in the survey suggested small-scale pressure production.[115] However, the connection between regular 'pre-Neolithic' assemblages with rare artefacts implying about possible pressure débitage remains unclear.

The pressure technique is recognised at sites belonging to the earliest Pottery Neolithic in the region around Eskişehir and Bursa. Exhausted blade cores and unidirectional conical and bullet cores with preparation of the knapping face showed the presence of pressure technique at Barcın Höyük. Additional information about blade and bladelet widths pointed out the possible practicing of pressure blade detachment in the standing position.[116] Similarly, the presence of small bullet cores in flint and obsidian shaped in hand, and the occurrence of larger prismatic cores and bladelets points to the use of sitting and standing pressure at Aktopraklık C, dated to the second half of the 7th millennium BC.[117] As suggested by the author, due to the shape of cores, the chipped stone industry of Aktopraklık C seems to have developed on the traditions of the local Mesolithic/Epipaleolithic period.[118]

The broad study of South Marmara Neolithic lithics by I. Gatsov brought about debate questioning the derivation and distribution of bullet cores in north-western Anatolia during the 7th and 6th millennia BC.[119] The abundance of single-platform conical, semi-conical and bullet cores in sizes from 5–7cm, made of flint, and less frequently of obsidian, followed by regular blades, attested to the pressure technique at the sites of Ilıpinar, Pendik, Fikirtepe and Menteşe.[120] Accord-

109 Carter – Shackley 2007, 440.
110 Carter et al. 2006, 906–907.
111 Carter – Milić 2013, 502.
112 Gatsov – Özdoğan 1994; Özdoğan – Gatsov 1998. See also Fig. 1.7 in this volume.
113 Gatsov 2005, 216.
114 Gatsov – Özdoğan 1994.
115 Özdoğan – Gatsov 1998, 221.
116 Gatsov et al. 2011.
117 Balcı 2011; Karul 2011, 28.
118 Balcı 2011, 8.
119 E.g. Gatsov 2005.
120 Gatsov 2003; Gatsov 2009; Gatsov – Nedelcheva 2011.

ing to I. Gatsov, the bullet core tradition lasted around one thousand years, and has been observed over the vast territories of North West Pontic, Upper and Eastern Thrace, South Marmara, and central and southwest Anatolia.[121]

Recently published Neolithic sites from coastal Troad – Coşkuntepe[122] and the Aegean island of Gökçeada-Uğurlu[123] have yielded new information about the existence of pressure blade making in the second half of the 7th millennium BC. Pressure blades and bladelets made of flint and obsidian testify about pressure débitage at Coşkuntepe. While the application of the pressure technique on prismatic bullet cores in flint seem to have been done by knappers from the settlement, local pressure blade detachment for obsidian[124] has not been confirmed yet, due to the lack of cores.[125] Lithic material from Uğurlu, with obsidian present only at 1% within the assemblages,[126] demonstrated similarities in chipped stone artefacts in levels V to III, with general lack of cores, except for two prismatic bullet cores. Regular pressure blades have been most frequent in phases V and IV,[127] while pressure débitage is not excluded even from the context of finds corresponding to Karanovo macro-blades, usually detached by percussion.[128]

Finally, it seems that questionable data regarding the chronology of south-western Anatolia influenced publications of lithic data sets for the 7th millennium BC Lake District.[129] It is clear that bullet cores have been found in Hacilar,[130] but further definition of pressure blade making is not possible at the moment. Less ambiguous information may be obtained for Höyücek, since the pressure technique for blade making has been recognised in assemblages of regular blades and unidirectional blade cores and bullet cores in flint during the Pottery Neolithic period at the settlement.[131]

II.7. Discussion

Diffusion of pressure blade making from the presupposed centre of origin in eastern Asia in the Upper Paleolithic occurred from east to west. The rapid spread of the pressure technique over vast areas is attributed to mobile hunters. The transmission of this technique in its basic forms culminated in the Holocene, progressing westward across the Old World.[132] The evolution of pressure débitage in Anatolia seems to have its roots in lithic industries of the 10th and 9th millennia in eastern Mesopotamia based on blade detachment on conical flint cores.[133] Furthermore, the appearance of conical cores with reduction leading to bullet shapes connects Eastern Mesopotamia with possible antecedents in the regions of Afghanistan, Pakistan and the Caucasus.[134] It appears that this tradition persisted until the third millennium BC in the Old World.[135]

Pressure blade making seems to be an extremely advantageous and opportunistic method for obtaining masses of regular blades once the technique was learned and adopted. It is clear that

121 Gatsov 2005, 218.
122 Takaoğlu – Özdemir 2013.
123 Erdoğu 2013.
124 Within 110 obsidian samples, Laser Ablation (LA-HR-ICP-MS) analysis showed Melian provenance for the majority of samples, while only 8 pieces corresponded to Central Anatolian outcrops (Perlès et al. 2011).
125 Perlès et al. 2011, 47; Takaoğlu – Özdemir 2013, 36–37.
126 Low amounts of obsidian corresponded both to Melian and Göllü Dağ sources.
127 Erdoğu 2013, 7.
128 Guilbeau – Erdoğu 2011.
129 For the latest update on the Neolithic sites of the Lake District see Duru 2012.
130 Gatsov 2005, 218.
131 Balkan-Atlı 2005.
132 Inizan 2012, 35.
133 Binder 2007, 240.
134 Wilke 1996, 291.
135 Inizan 2012, 18.

there is a strong connection between pressure technique and the economies of prehistoric communities. In the Upper Paleolithic this can be suggested for the case of microliths (microlithic blades) made by pressure technique; from the other hand the evidence from Kaletepe workshop in Cappadocia attested that the long regular pressure blades with rectilinear profiles were ideal for the manufacture of arrowheads. A second wave of connections can be observed in the Neolithic period, especially during the 7th millennium BC, where the abundance of pressure blades was related to production of sickle implements.[136]

The dispersal and adoption of different modes of pressure technique may have resulted through the transmission of ideas, contacts between groups, in knowledge exchange based on the teaching-learning concept, or through migration of individuals with 'know how' or groups that included such people. It must be emphasised that it is possible that communities that had no previous experience with pressure technique would start practicing it *ex nihilo*. Pelegrin demonstrated the relationship of knowledge in applying pressure in different modes by using different amounts of force, and possibilities of switching from easier to more sophisticated methods.[137] This study can be successfully applied to many Neolithic communities in Anatolia from the 9th to 7th millennia, with the first appearance of pressure in simple forms of small cores detached by hand pressure, rather than immediate introduction of complex forms of pressure technique relying on devices for pressure detachment and core immobilisation.

As the case study for the 7th millennium BC in Anatolia showed that the presence of pressure blade making at Çatalhöyük and Çukuriçi Höyük occurred within a similar time span, yet with some 150–200 years older pressure débitage recognised at Çukuriçi Höyük.[138] Dealing with western Anatolian lithic assemblages here not only shed light on the Aegean Turkey within a broader image depicting the emergence of pressure blade making in Anatolia, but also gave new results concerning the long-standing opinion that central Anatolia, with focus on Çatalhöyük, should be considered as the origin of different Neolithic features, including pressure débitage, towards western Anatolia and the Aegean.[139] Finally, with evidence of early pressure débitage at Çukuriçi in the first half of the 7th millennium BC, central Anatolian roots for western lithic technology should be excluded.

The presence of pressure blade making within the surveyed material from north-western Anatolia, at sites of the Ağaçlı group and Çalca and Musluçeşme remain questionable due to the state of finds. However, the pressure technique seems to be an alien element in 'pre-Neolithic' contexts on the west, as confirmed from Küçükçekmece and Keçiçayırı.[140] Additionally, the occurrence of obsidian material knapped by pressure, in such early contexts is rather strange, since the procurement of obsidian from two possible sources – Melian or Cappadocian in north-western Anatolia – is documented only from the 7th millennium BC onwards. However, pressure débitage of north-western Anatolian Pottery Neolithic sites, marked with the abundance of bullet cores, was often seen as part of the lithic industries relying on previous Mesolithic/Epipaleolithic substratum.[141]

To the contrary, no 'pre-Neolithic' assemblages coming from secure contexts in western Anatolian coast have been identified so far, except for the lately dated Girmeler cave in the 9th and 8th millennia BC, located further south in the region of Fethiye, with a flake-based flint industry.[142] A similar case, a flake-based industry of white patinated flint was recorded within the recent

136 Astruc 2011, 259; Inizan 2012, 18.
137 Pelegrin 2012, 493–494.
138 The foundation of the settlement with present pressure blade making relates to around 6700 BC. See also Horejs et al. 2015 and chapter I in this volume.
139 Binder 2007; Altınbilek-Algül et al. 2012; Binder et al. 2012.
140 Efe 2005; Gatsov – Nedelcheva 2011; Efe et al. 2012; Özdoğan 2013.
141 Gatsov 2003; Gatsov 2009; Balcı 2011.
142 Takaoğlu et al. 2014.

survey of the Karaburun peninsula,[143] which confirms that the possible pre-Neolithic sequence in the Aegean Anatolia go alongside the western evidence known from the Mesolithic in Greece.[144]

Assemblages of obsidian at Neolithic sites of the Izmir region contrast with the dominance of obsidian over the use of chert from Çukuriçi Höyük, at around 80–85%. The information about obsidian presence at around 20% at Ege Gübre,[145] 15–20% at Ulucak and 20–25% at Yeşilova,[146] speak in favour of using locally available chert sources for chipped stone artefacts. Even though there is a tendency for pressure blade making during the Neolithic in the Izmir region, flake industry and direct and indirect percussion seem to be as frequent as pressure débitage at most sites, except for Çukuriçi, which is marked by the clear abundance of pressure blade products. This situation allows us to observe that lithic industry and applied techniques in tool production are caused by the choice of raw material to a great degree. It seems that the reliance on pressure technique in blade production at Çukuriçi comes as a logical answer for the use of the exotic material. Involving any other technique would cause a great loss of the raw material procured over long distances due to the uncontrolled nature of the knapping and would initially require larger cores for keeping a blade industry at the settlement. One of the interesting questions raised now is whether the obsidian is specifically imported to the settlement for the 'mass production' of pressure blades, or the other way around – having obsidian in large quantities caused the 'mass production' of pressure blades. Possible scenarios of opportunistic procurement of obsidian for further distribution testify to the complexity of the aims of the lithic production at Çukuriçi Höyük.

The evidence for pressure technique in the beginning of the Neolithic occupation of the settlements in the same region can provide more information about the regional networks in the first half of the 7th millennium BC, as well as the relation between the raw materials and pressure technique. At the moment the earliest contexts of Ulucak VI and Çukuriçi XIII can be taken as a case study for two difference patterns – while at the earliest Ulucak layer the virtual lack of obsidian goes alongside the absence of pressure technique, whereas at the nearby site of Çukuriçi, both raw material and the locally practiced pressure blade making were available. The limited interactions with coastal habitats, based on the rare finds of marine molluscs within Ulucak VI[147] may speak in favour of the hypothesis that the beginning of pressure technique has to do with obsidian. At the current state of research, the settlers of the earliest excavated phase of Çukuriçi Höyük (ÇuHö XIII) may be seen as the best candidates for the ownership of the knowledge of pressure technique in the region. Since there were no Neolithic communities settled on the Cycladic islands before the 5th millennium BC[148] and in accordance with the fact that preparation of cores for pressure blade making must have been done by people already specialised in pressure débitage, we suggest that there were organised expeditions for raw material procurement from Melos by knappers from Çukuriçi (Fig. 2.8). Experimental research on models of obsidian acquisition for a case study from Sabi Abyad suggested possible carrying capabilities of 30kg of raw material per person, shaped in forms of cores weighting around 1kg or less, which might have been brought by several craftsmen during seasonal visits to the source.[149]

In an alternative scenario, one could expect the pressure technique and established exchange networks for the distribution of obsidian led by Aegean Neolithic groups within at least same period, if not even earlier. No traces of pressure blade making has been confirmed in the Mesolithic or

143 Çilingiroğlu et al. 2016
144 E.g. Galanidou – Perlès 2003; Sampson 2010.
145 Sağlamtimur 2011, 81.
146 Personal communication with excavators Özlem Çevik and Zafer Derin.
147 Çilingiroğlu et al. 2012, 149.
148 Broodbank 2000.
149 For further comments on maximum number of blades which could be detached from single core see Astruc et al. 2007.

Fig. 2.8 Map of western Anatolia with suggested model of the obsidian raw material procurement from the Neolithic Çukuriçi Höyük (map: M. Börner, B. Milić)

Epipaleolithic contexts so far in the Aegean.[150] The evidence of the first pressure technique in the Aegean world comes from Early Neolithic Franchthi and Argissa Magoula in Thessaly.[151] However, pressure knapping has been applied on local and exotic flint, and Melian obsidian, while the authors question the raw material procurement by local settlers in case of obsidian.[152] According to recent publications concerning the debate on radiocarbon dating of the Aegean and western Anatolia,[153] no measurable age-difference between the earliest known data of arrival of the Neolithic in Franchthi and sites at Turkish West Coast has been observed.[154] Due to the presence of

150 E.g. Sampson 2010; Sampson 2014; Efstratiou et al. 2014; Carter et al. 2016.
151 Perlès 2001, 78; Perlès et al. 2013.
152 Perlès 2001, 51.
153 E.g. Brami 2015.
154 Weninger et al. 2014, 22.

locally made pressure technique on the west and additional strong evidence for the use of the sea by settlers of Çukuriçi based on the aforementioned archaeozoological data, obsidian distribution by Aegean Neolithic groups in the direction of western Anatolia is unlikely.

Finally, the presence of cache of obsidian long blades, knapped by standing pressure, indicates parallels between Upper Mesopotamian, Levantine and Cyprian Pre-Pottery and Pottery Neolithic[155] and Çukuriçi Höyük. The application of pressure technique using a lever seems to have been practiced from LPPNB in eastern Anatolia around 7500–7250 calBC.[156] Fragmented large blades obtained by lever pressure have been found in the Early Neolithic of Franchthi as well, in the level dated to 6624–6378 calBC.[157] As C. Perlès convincingly discussed, pressure débitage along with other features of the Earliest Neolithic, such as the use of mud bricks, plastered floors, buttresses, complex composite hearths, and bone tool production offer evidence for possible colonisation of Greece from the Near East.[158] An analogous level of specialisation visible in detaching very wide blades proposed for Çukuriçi Höyük may apply a similar eastern tradition.

II.8. Conclusion

After the appearance of the pressure technique in Anatolia in the 9th millennium BC, bounded to regions of Upper Mesopotamia and Cappadocia, it appears that the penetration of pressure debitage into other regions of Anatolia takes place during the 7th millennium BC. The occurrence of the pressure technique in Neolithic sites here should be seen as resulting from connections between mobile groups from different regions. However, lack of published lithic data sets from western Anatolia has excluded the Izmir region from the broader picture of the emergence of pressure blade making in Anatolia.

The earliest documented practicing of pressure technique on the western Anatolian coast appears to be around 6700–6600 BC at Çukuriçi Höyük. Different modes used in pressure blade making at the site assert the presence of developed pressure technique and imply certain levels of specialisation by local craftsmen. The strikingly high amounts of obsidian within the lithic assemblages during the whole occupation of the settlement contrasts with the raw materials used in tool production during the Neolithic period at other sites of the region, and therefore suggests full reliance on pressure technique in lithic industry of Çukuriçi Höyük.

The 7th millennium BC in Anatolia seems to be a turbulent period including connections between regions far from each other and westward expansions from the core zones. Preliminary results of this study showed that pressure blade making was already practiced in Çukuriçi Höyük lithic production within its earliest occupation phase. One of the questions refers to the influence of obsidian, as being a trigger in spreading of pressure technique on regional basis. New results of lithic analysis from contemporaneous Ulucak can provide information for such questions.

The origin of pressure blade making for the initial appearance in the foundation of Çukuriçi Höyük one may seek further east, where its development has been documented at least in the beginning of 7th millennium BC. There are two possible centres of origin for the pressure technique on the western Anatolian coast, with Çukuriçi as a case study. First is the region of eastern Anatolia, which was already suggested as the starting point for the appearance of pressure débitage at Çatalhöyük around 6500 calBC. So far, besides possible activations of connections between eastern Anatolia and western regions, the exceptional features of pressure blade making at Çukuriçi, such as frontal débitage, i.e. the use of wedge-shaped cores support this hypothesis. A second possible centre of origin is Eastern Mesopotamia, where conical pressure cores have

155 E.g. Astruc et al. 2007.
156 Altınbilek-Algül et al. 2012, 162.
157 Perlès 2004, 29; Pelegrin 2006, 48.
158 Perlès 2001, 54.

long tradition from 10th to 3rd millennia BC. For the first time, due to the recognition of the pressure technique, lithic assemblages of western Anatolian coastal Neolithic sites can be considered together with the Aegean elements concerning the Eastern Mediterranean influences in developing the Neolithic way of life in the west.

The abundance of exotic obsidian correlating with a fully developed pressure technique, viewed as a certain commodity that the settlement possessed, together with raw material procurement by local artisans gives Çukuriçi Höyük a character of an important place in redistribution of raw materials in the region. At the same time, Çukuriçi seems to represent the connection between the Izmir region and Aegean raw material sources, which might have influenced additional spreading of knowledge of pressure blade making in the region.

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