



## Please help us find the origins of Greek and Italian Early Neolithic lever pressure-flaking!

Denis Guilbeau, Catherine Perlès

### ► To cite this version:

Denis Guilbeau, Catherine Perlès. Please help us find the origins of Greek and Italian Early Neolithic lever pressure-flaking!. Laurence Astruc, Carole McCartney, François Briois et Vasiliki Kassianidou. NEAR EASTERN LITHIC TECHNOLOGIES ON THE MOVE. INTERACTIONS AND CONTEXTS IN NEOLITHIC TRADITIONS 8th International Conference on PPN Chipped and Ground Stone Industries of the Near East, Nicosia, November 23rd-27th 2016, Astrom Editions, pp.511-518, 2019. halshs-03878341

**HAL Id: halshs-03878341**

**<https://shs.hal.science/halshs-03878341>**

Submitted on 16 Dec 2022

**HAL** is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

STUDIES IN MEDITERRANEAN ARCHAEOLOGY  
VOL. CL

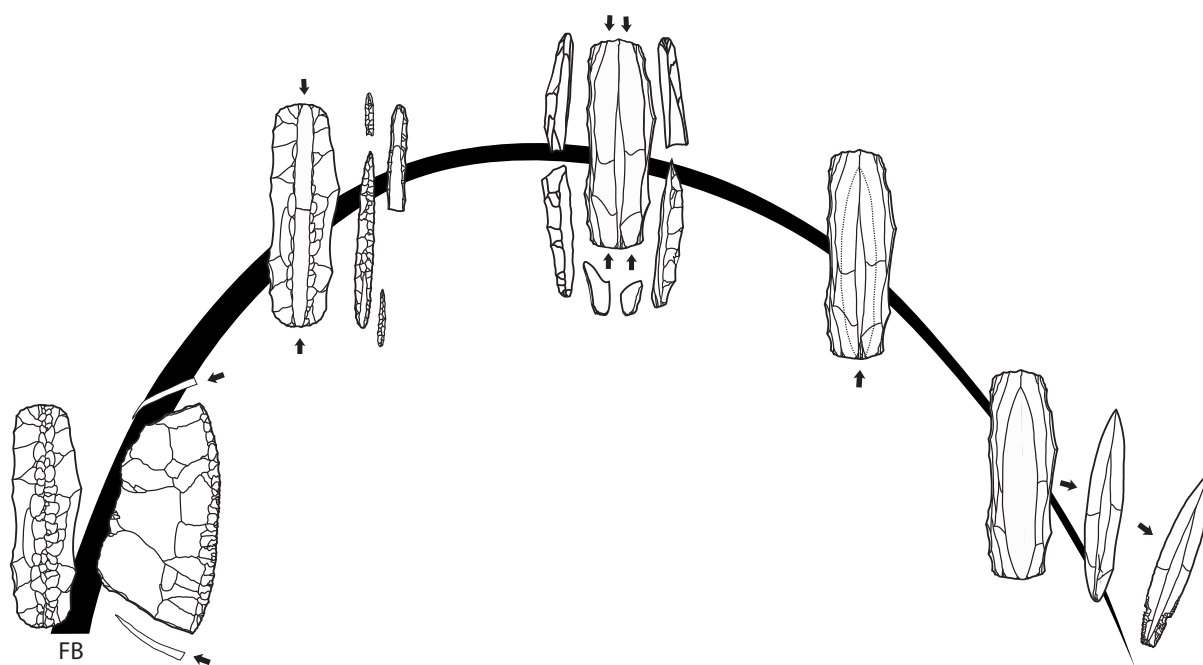
---

# NEAR EASTERN LITHIC TECHNOLOGIES ON THE MOVE. INTERACTIONS AND CONTEXTS IN NEOLITHIC TRADITIONS

8th International Conference on PPN Chipped and Ground Stone  
Industries of the Near East, Nicosia, November 23rd–27th 2016

edited by

Laurence Astruc, Carole McCartney, François Briois  
and Vasiliki Kassianidou



ASTROM EDITIONS  
NICOSIA 2019

STUDIES IN MEDITERRANEAN ARCHAEOLOGY

Volume CL

Founded by Paul Åström

**VEPMO**  
Du Village à l'État au  
Proche et Moyen-Orient

UMR 7041  
**ARSCAN**  
ARCHÉOLOGIES ET  
SCIENCES DE L'ANTIQUITÉ  
CNRS - Univ. Paris 1  
Univ. Paris 1 - Ministère de la Culture



UNIVERSITÉ PARIS 1  
**PANTHÉON SORBONNE**

université  
**Paris Ouest**  
Nanterre La Défense



University  
of Cyprus

**Editors-in-Chief**

Jennifer M. Webb

David Frankel

La Trobe University, Melbourne  
sima@astromeditations.com

**Editorial Board**

Shlomo Bunimovitz

Jan Driessen

Nikos Efstratiou

Peter Fischer

Jeannette Forsén

Maria Iacovou

Reinhard Jung

Vassos Karageorghis

Robert Merrillees

Demetrios Michaelides

Despo Pilides

Nancy Serwint

Joanna S. Smith

Carl-Gustaf Styrenius

Cover image: Parekklisha *Shillourokambos*, Cypro-PPNB bipolar blade core technology  
(drawing by F. Briois)

Published by Astrom Editions  
Banérg 25 SE 752 37  
Uppsala, Sweden  
[www.astromeditations.com](http://www.astromeditations.com)

© Astrom Editions 2019  
ISSN: 0081-8232  
ISBN 978-9925-7455-3-1  
Print: Bulls Graphics, Halmstad

This volume is dedicated to the late  
Nikolai Ottovitch Bader, Nur Balkan-Atli, Edgar Peltenburg and Klaus Schmit

The opportunity to hear about ongoing field-work and new discoveries in parts of the Middle East—in spite of the devastation occurring elsewhere. Like our recently departed colleagues, whom we miss, we are united by a passion for prehistory. The PPN8 participants expressed this passion by reaching across ideological boundaries to share data, debate concepts and join in reveries that allow us to preserve the best of what makes the Near East so special to all of us.



# Contents

Table of contents	v
Editors' preface	ix
List of contributors	xi

## Cyprus focus

1. Jean-Denis Vigne, François Briois and Jean Guilaine <i>Klimonas</i> , the oldest Pre-Pottery Neolithic village in Cyprus	3
2. Alain Le Brun Khirkitia on the move: a Late Aceramic Neolithic site in Cyprus	13
3. Jean-Denis Vigne, François Briois and Jean Guilaine To what extent has insularity played a role in the Cyprus Neolithic transition?	19
4. Alan H. Simmons No chipped stone is an island: a reimagining of the role of early Cyprus within the Neolithic world	31
5. François Briois and Laurence Astruc Introduction, adaptation and development of the first Pre-Pottery Neolithic communities in Cyprus: the contribution of lithic industries in the Amathus area	45
6. Laurence Astruc and François Briois Harvesting tools during the Pre-Pottery Neolithic in Cyprus	53
7. Carole McCartney and Giusi Sorrentino Ayia Varvara <i>Asprokremnos</i> —a preliminary analysis of stone tools used in pigment processing and tanning with ochre	63
8. Jérôme Robitaille and Vasiliki G. Koutrafourli 'Message in a wall': macrolithic tools within PPNA constructions at <i>Klimonas</i> in the light of ethnoarchaeological evidence	79
9. Jérôme Robitaille and François Briois Pebbles used as retouchers/compressors during the PPNA at Ayios Tychonas <i>Klimonas</i> , Cyprus	95
10. Renée Corona Kolvet <i>Ais Giorkis</i> : reflections on an upland Cypro-PPNB ground stone assemblage	103
11. Shaun Murphy, Peter Bikoulis and Sarah T. Stewart Finding the way: predictive modelling and the Early Neolithic in the eastern Troodos foothills of Cyprus	111
12. Theodora Moutsiou Raw material circulation and the Early Holocene social landscape of Cyprus	119

## **Lithics in social and economic contexts**

13. Dana Shaham and Leore Grosman  
Engraved stones from Nahal Ein Gev II—portraying a local style, forming cultural links 133
14. Michal Birkenfeld, Lena Brailovsky-Rokser and Ariel Vered  
'Ein Dishna, a new PPNA site in the Jordan Rift Valley, Israel 143
15. Sam Smith, Bill Finlayson and Steven Mithen  
The end of the PPNA in southern Jordan: insights from a preliminary analysis of chipped stone from WF16 159
16. Dörte Rokitta-Krumnow  
The chipped stone industry of Mushash 163: a PPNA/EPPNB site in the Badia/northeastern Jordan 173
17. Sumio Fujii, Takuro Adachi and Kazuyoshi Nagaya  
Harrat Juhayra 202: an Early PPNB flint assemblage in the Jafr Basin, southern Jordan 185
18. Cristoph Purschitz  
The lithological landscape of the Greater Petra Region, Southern Levant. Availability of chert and other abiotic resources 199
19. Cristoph Purschitz  
Socio-economic changes in flint production and consumption among the PPNB lithic economies of the Greater Petra Region, Southern Levant 213
20. Nurcan Kayacan and Çiler Algül  
A knapping area in an 8th millennium BC building at Aşıklı Höyük, east-central Anatolia 227
21. Semra Balcı  
The obsidian industry of Pre-Pottery Neolithic levels at Tepecik-Çiftlik, central Anatolia 235

## **Technology and specialisation**

22. Osamu Maeda and Cinzia Pappi  
Bladelet production by pressure-flaking at the Proto-Neolithic site of Satu Qala in Iraqi Kurdistan 249
23. Ferran Borrell, Juan José Ibáñez, Juan Muñiz and Luís Teira  
The PPNB chipped stone industries from Kharaysin (Zarqa Valley, Jordan): preliminary insights 257
24. Frédéric Abbès  
Production de lamelles et de microlithes dans le Bal'as : un nouveau faciès du PPNA en Syrie 267
25. Christoph Purschitz  
A MPPNB bidirectional blade workshop at Shkârat Msaied, Southern Levant 277
26. Maya Oron, Ron Lavi and Joel Roskin  
Mitzpe Ramon: a flint quarry and blade production workshop from late PPN to early PN in the Negev, Israel 287

## **Innovative stone technologies in the development of agricultural practices**

27. Itay Abadi and Leore Grosman  
Sickle blade technology in the Late Natufian of the Southern Levant 295

28.	Fiona Pichon Utilisation des outils en silex pour l'exploitation alimentaire et artisanale des végétaux à Dja'de el-Mughara durant le PPNB ancien (Syrie, 9ème millénaire)	305
29.	Lena Brailovsky-Rokser and A. Nigel Goring-Morris Pre-Pottery Neolithic B sickle blades in regional context: evidence from Galilee	323
<b>Continuities and discontinuities</b>		
30.	Iris Groman-Yaroslavski The emergence of a blade-oriented industry during the PPNA—technology embedded in a Natufian concept	343
31.	Tobias Richter and Maria Mawla Continuity and discontinuity in the Late Epipalaeolithic (Natufian): the lithic industry from Shubayqa 1	359
32.	Theresa Barket Flaked-stone assemblage variation during the Late Pottery Neolithic B at 'Ain Ghazal: what could it mean?	369
33.	Ferran Borrell, Fanny Bocquentin, Juan Francisco Gibaja and Hamoudi Khalaily Defining the Final PPNB/PPNC in the Southern Levant: insights from the chipped stone industries of Beisamoun	381
34.	Stuart Campbell and Elizabeth Healey The obsidian from Umm Dabaghiyah, a Proto-Hassuna site in northern Mesopotamia	401
35.	Danny Rosenberg, Iris Groman-Yaroslavski, Rivka Chasan and Ron Shimelmitz Additional thoughts on the production of Chalcolithic perforated flint tools: a test case from Tel Turmus, Hula Valley, Israel	415
<b>Interactions and diffusion beyond the PPN</b>		
36.	Nigel Goring-Morris and Anna Belfer-Cohen Packaging the Levantine Epipalaeolithic: a view from the Negev and Sinai	429
37.	Makoto Arimura Some reflections on the obsidian 'Kmlo tools' of the Early Holocene culture in Armenia	449
38.	Bastien Varoutsikos and Arthur Petrosyan Blade-making in Aknashen, Armenia, and the origins of the Neolithic in the southern Caucasus (7th–6th millennium cal. BC)	461
39.	Yoshihiro Nishiaki and Farhad Guliyev Neolithic lithic industries of the southern Caucasus: Göytepe and Hacı Elamxanlı Tepe, west Azerbaijan (early 6th millennium cal. BC)	471
40.	Bogdana Milić An addendum to the PPNB interaction sphere. The lithic package from 7th millennium BC Çukuriçi Höyük in western Anatolia	485
41.	Denis Guilbeau and Burcin Erdoğu Chipped stones from the earliest Neolithic occupation in the northern Aegean (Uğurlu, Gökçeada Island, ca 6800–6600 cal. BC)	503
42.	Denis Guilbeau and Catherine Perlès Please help us find the origins of Greek and Italian Early Neolithic lever pressure-flaking!	511



# Please help us find the origins of Greek and Italian Early Neolithic lever pressure-flaking!

Denis Guilbeau and Catherine Perlès

## Abstract

The Neolithic way-of-life is considered to have been introduced in Greece and southern Italy by migrant farmers from Anatolia or the Near East, during the 7th millennium cal. BC in Greece, the early 6th millennium in Italy. In both regions Early Neolithic lithic assemblages yielded long blades produced by a very specific technique, pressure-flaking with a lever. The raw materials and technical details differ, but independent local invention of this complex technique, which requires important know-how and knowledge, appears highly unlikely. It can thus be presumed that pressure-flaking with a lever was introduced with all the other new elements and techniques brought by Neolithic farmers, and that its origins must be sought in Anatolia and the Levant. The earliest evidence for lever pressure in these regions is provided by the large obsidian blades from Çayönü, in the second half of the 8th millennium, followed, one millennium later, by the obsidian blades of Sabi Abyad 1. According to the raw material, the workshops must have been located in eastern Anatolia (Bingöl/Nemrut Dağ area).

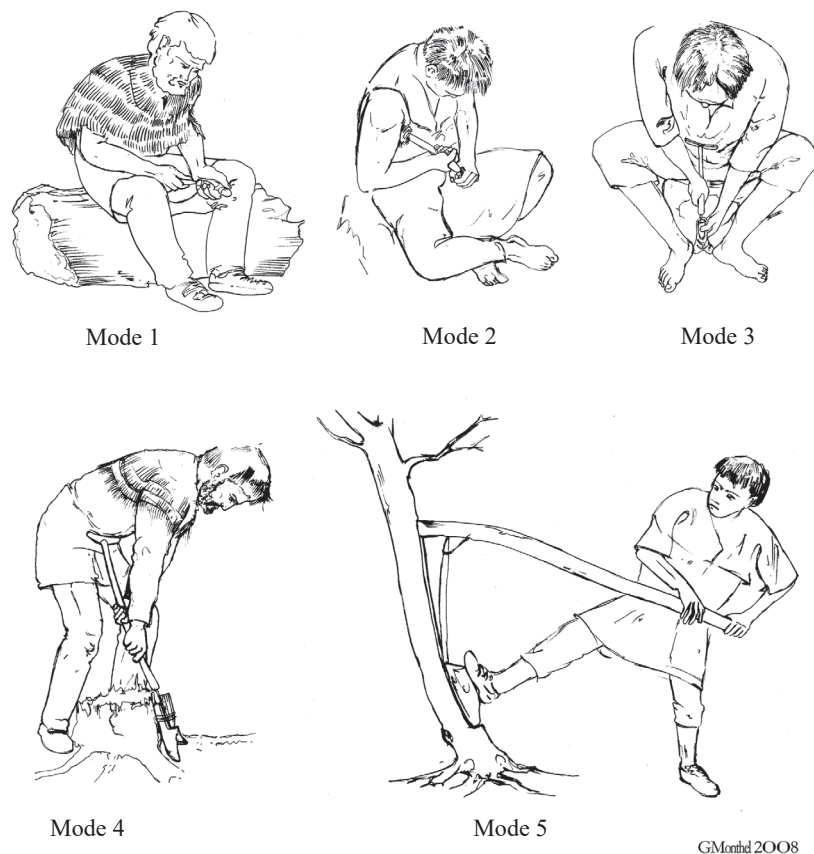
A direct introduction of the technique from eastern Anatolia to Greece and Italy can be ruled out, but lever pressure-flaking has only been mentioned in western Anatolia in Çukuriçi, near Izmir, on Melian obsidian and on a supposedly local flint. It is highly unlikely, however, that lever pressure-flaking was restricted to this site or this region. There is indeed no argument in favour of a direct link between the Greek and the Italian earliest Neolithic settlements, which differ with regard to their chronology, architecture, ceramics, etc. We should therefore look for several regions of origin, possibly or probably making use of different raw materials and variants of the technique.

Our presentation, thus, simply wishes to draw attention to these specific productions, whose singularity and specificities constitute an excellent marker of regional technical traditions and should help to define the routes followed by the early colonists of Europe.

## Introduction

The production of long blades by pressure-flaking with a lever is one of the most impressive Neolithic innovations in the domain of chipped stone workmanship. It was identified in particular for the exceptional flint blades uncovered at the Varna cemetery in Bulgaria, dating to the mid-5th millennium cal. BC and attributed to the Karanovo VI-Kodjadermen-Gulmenitsa Culture. The longest intact blade measures 43cm and was deposited in the richest tomb (Burial 43), exemplifying the clear relation between the richness of the tomb in terms of the variety and quality of the offerings, and the length of the blade deposited with the deceased (Manolakis 2005: 211–212). The Varna blades are certainly the most spectacular, but they are not, and by far, the oldest in Europe. As we shall show, they are present in Greece and Italy at the dawn of the Neolithic. However, how this elaborate technique reached Europe and where it came from remain to be investigated. Our presentation thus wishes to draw attention to these specific productions, whose singularity should constitute an excellent marker of regional technical traditions and help to define the routes followed by the early Neolithic colonists of Europe.

Pressure-flaking with a lever is the most demanding technique in blade production (Manolakis 2005, 2006; Pelegrin 2006). Jacques Pelegrin, who has done extensive experimentation on pressure-flaking, has defined five pressure-flaking modes (**Fig. 1**) that require more and more force as the products detached become larger (Pelegrin 2012a). The amount of force required, however, depends on the width rather than the length of the blade, as stated a long time ago by D. Crabtree (1968; and see Altınbilek-Algül *et al.* 2012: 172). Small bladelets can be detached with a hand-held pressure tool (mode 1) or a shoulder crutch (mode 2). A short crutch used in a sitting position (mode 3) allows the detachment of narrow blades or bladelets, while flint blades up to 20–21mm wide with an organic tip on the crutch, or 21–22mm with a copper



GMonthel 2008

Figure 1. The five modes of pressure-flaking defined by J. Pelegrin (drawings by G. Monthel © J. Pelegrin)

tip, can be produced with a long crutch in a standing position (mode 4). To detach even larger blades by pressure, from 22–40mm wide in flint and 26–40mm or even 50mm wide in obsidian, human strength no longer suffices and the pressure crutch needs to be fixed to a lever, which characterises mode 5 (Pelegrin 1988, 2006, 2012a: fig. 18.10; Altınbilek-Algöl *et al.* 2012: 172). Indeed, according to Pelegrin's estimate, a force of 200–300kg is required to detach a flint blade of 3–4cm wide and 30cm long (Pelegrin 2012a: 477–478). Above 5cm wide, the blade tends to be blocked in the stabilising device, which creates additional difficulties (Pelegrin, *pers. comm.* 27/10/16).

Like all pressure-flaked blades and bladelets, mode 5 blades tend to present a high width/thickness ratio, regular edges and ridges, a straight or only slightly curved profile, a short and usually well-delimited bulb, frequent fine compression ripples but no wide undulations as occur with indirect percussion (Tixier 1984; Pelegrin 1988, 2004; see Astruc *et al.* 2007).

Various lever systems were tested by Pelegrin (1988, 2012a), Volkov and Guiria (1991), Abbès and Arrok (Abbès 2013) and Kelterborn (2012) for instance, and, although some are more effective than others or easier to set up, all allow the detachment of blades. What really matters is the elasticity of the crutch, the previous shaping of the core and its tight immobilisation when high pressure is applied.

The tip of the crutch itself can be made either from antler or from copper. Depending on the tip and on local preferences, the platform can be flat or faceted; consequently, the butts are flat, dihedral or faceted. A lip can occur, especially on blades produced with an antler tip (see Pelegrin 2012b: fig. 4).

Long blades produced by percussion are usually less regular and always more curved. Indirect percussion is the only other technique that allows the production of light regular blades, i.e. with a high ratio width to thickness. However, their dimensions are smaller on average (15–18cm) and the frequent undulations on the detachment surface, caused by the shock of percussion, diminish the overall regularity. The workshops of the Grand-Pressigny are the only ones that, through a very specific method of indirect percussion, succeeded in producing long blades that can compare with the best productions by lever pressure (Pelegrin 2002, 2012b).

If the long blades from Varna are among the most spectacular lever pressure-flaked blades, they are not the earliest in Europe. Pressure-flaked blades are indeed present in the earliest Neolithic contexts from Greece and Italy. These blades are not associated with elite funerary burials but mostly with domestic contexts. They are certainly less spectacular, but they nevertheless demonstrate the very early use of this complex and sophisticated technique.

## Neolithic pressure-flaked blades

### Greece

Although they were not initially recognised as such, some of the oldest lever pressure-flaked blades probably come from Stratum 31c at Argissa in Thessaly (**Fig. 2**). This stratum belongs to the debated 'Preceramic' (or Initial Neolithic) phase of this long-lived settlement and may pre-date 6500 cal. BC (Milojčić *et al.* 1962; Perlès 1987, 1990; Reingruber 2005). However, the fragments do not encompass the proximal ends so that the diagnosis remains unconfirmed. The oldest blades in Greece (and in Europe) that can assuredly be identified as pressure-flaked with a lever come from secure Early Neolithic levels at Franchthi (Argolid), dated between 6600 and 6000 cal. BC (Pelegrin 2004; Perlès 2004; Roux *et al.* 2013). The Q5N 57 and H1A 80 proximal fragments (**Fig. 2**) are highly characteristic with their very prominent, small and well delimited bulb, their rectilinear and perfectly regular profile and rectilinear arises above the counter-bulbs. The wide flat butts without cracks indicate the use of a rather soft tip, such as antler. Even without the proximal part, the rectilinear arises and flat section of G 21 indicate pressure-flaking, while its width clearly required the use of a lever.

Franchthi appears to be especially rich in large lever pressure-flaked blades and yielded numerous Middle Neolithic specimens (ca 6000–5500 cal. BC). Most are segmented and lack their proximal end (**Fig. 2**). However, despite intense retouching, they too present the three diagnostic features that, when combined, allow the identification of lever pressure: extreme regularity of the dorsal ridges, rectilinear profile and high width to thickness ratio (Pelegrin 1988: 48). The rarely preserved Middle Neolithic butts tend to be faceted, but there is no evidence for the use of a copper tip until the Late Neolithic. A few lighter blades may have been produced with a standing crutch (mode 4), but there is no evidence at Franchthi that this mode of flaking was systematically used after lever pressure-flaking to obtain smaller blanks. The lever pressure-flaked blades were primarily used as sickle blades, with multiple cycles of use and retouch, and often transformed afterwards into a different tool (end-scraper, transverse arrowhead, point) or even re-flaked to produce small bladelets and flakes that are also retouched (Perlès 2004).

This intense use and re-use can be taken as a testimony of their high value, probably linked both to their exotic character and the high quality of the raw material. Pressure-flaked blades are, for the majority, made on several varieties of very fine-grained, homogeneous, translucent beige to brown flints called 'honey flint' by lithic specialists in Greece, but which should not be confused with the Balkan 'honey flint' from Bulgaria (Gurova *et al.* 2016). Large 'honey flint' blades are known all over Greece, from EN Nea Nikomedeia in Macedonia to Alepotrypa

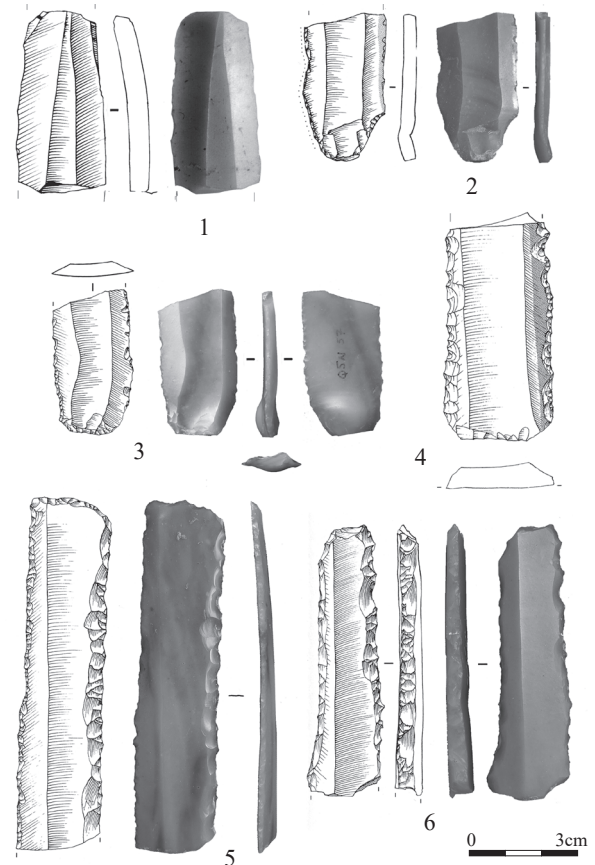


Figure 2. 1. Probable lever pressure-flaked blade from an Initial Neolithic context at Argissa (Thessaly), 2–4. Early Neolithic lever pressure-flaked blades from Franchthi (Argolid), 5–6. Middle Neolithic lever pressure-flaked blades from Franchthi (Argolid) (drawings M. Ballinger, photographs C. Perlès)

in the southern tip of the Peloponnese. They have always been found in small quantities, with no perceptible concentration beyond the west coast, and were always imported as finished products, usually already segmented. The sources and workshops are unknown but may be located on the northwestern coast of Greece and/or in Albania, where a large variety of flints and cherts are exploited alongside the 'honey flints'. The presence of very fresh white cortex on some specimens indicates that the flint was mined from primary deposits.

Pressure-flaked blades constitute a majority of the blanks produced on 'honey flints', but they would not all have required the use of a lever. Narrower blades could have been produced with a standing crutch (mode 4). Examples of these smaller modules (<2cm wide) can be found in the Early Neolithic of Franchthi (Perlès 2004) or the Middle Neolithic of Plateia Magoula Zarkou (Perlès in prep.). Rarer 'honey flint' blades produced by indirect percussion are also found in some Early and Middle Neolithic assemblages. This is the case, for instance, at Nea Nikomedeia in Macedonia or Plateia Magoula Zarkou in Thessaly (*pers. obs.*). Other small blades produced by indirect



percussion were made on a wide variety of exotic siliceous raw materials. Most come from unstratified collections (Chaeroneia, Choirospilia) or date to the Late Neolithic: Kitsos, Ayios Nikolaos, Tharrounia, for instance (*pers. obs.*). Indeed, the use of pressure-flaking on 'honey flints' or other exotic raw materials remains to be demonstrated for the Late Neolithic after 5600 cal. BC.

### Italy

In Italy, contrary to Greece, several sources of flint for the production of long blades have been identified (Guilbeau 2010, 2011). The richest are located in Puglia in the Jurassic/Cretaceous and Eocene formations of the Gargano; and were exploited through systematic underground mining since the Early Neolithic (Galiberti 2005; Tarantini & Galiberti 2011). Pressure-flaked blades manufactured by mode 4 and mode 5 techniques were present from the beginning of the Neolithic. The Defensola A mine was already exploited at about 6010–5720 cal. BC and has yielded Archaic impressed ware (Galiberti 2011: 145; Muntoni & Tarantini 2011: 44). Some blades probably crossed the Adriatic Sea and reached Croatia as early as 6000/5900 cal. BC (Brusić 2008; Korona 2009; Mazzucco *et al.* 2018; Podrug *et al.* in press; work in progress of Sonja Kacar and Zlatko Perhoč). In southeastern Italy, lever pressure-flaked blades are attested around 5800 cal. BC during the Guadone phase, in particular at Ripa Tetta and Rendina (Cipolloni 2002; Tozzi 2002; Collina 2016) but may have appeared even earlier. Large pressure-flaked blades become more abundant in the following phases. In the dense network of villages of the Tavoliere plain, southeast Italy, they were mostly found mixed within the total chipped stone assemblages, but sometimes also deposited in caches. From the mid-5th millennium onwards, lever pressure-flaked blades can also be found in graves.

The earliest EN long blades in Gargano flint are wide (about 30mm) and thick (at least 8mm), with straight edges and arises (Fig. 3). From about 5600 cal. BC, long blades become narrower and thinner, about 22mm wide and 5mm thick (at the limit of mode 4), but a few larger blades are still present (Fig. 3). There is a technical and morphological continuum between lever pressure-flaked blades and the blades that were removed subsequently from the same cores by standing pressure (mode 4). The width is, therefore, the only criterion we can use to differentiate them. The butts are faceted or flat, with a wide angle (almost 90°) and a careful preparation resulting in complete removal of the overhang on the dorsal face.

Two very early centres of production are also operating in Sicily (Guilbeau 2010), one linked to the very rich Hyblaean hills flint outcrops. The other has not yet been localised but is most probably in the central-western part of the island.

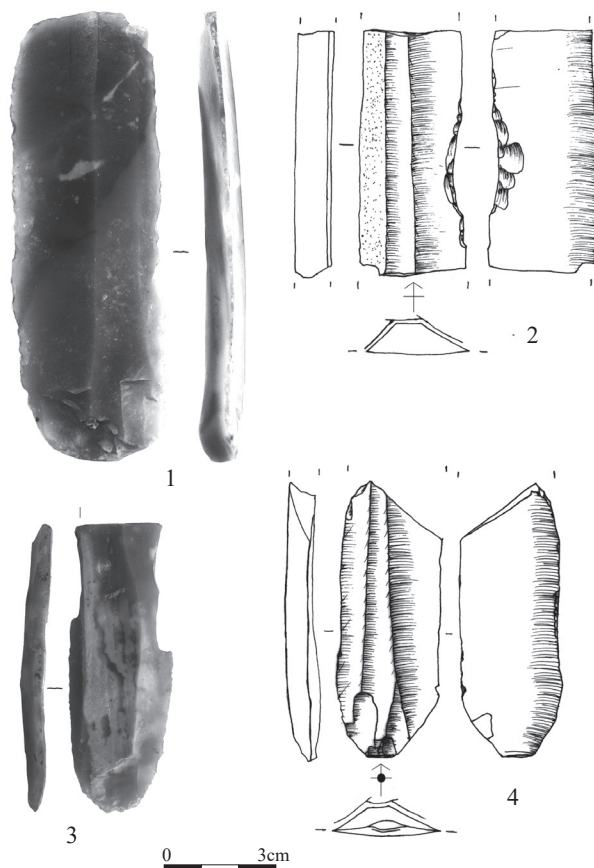


Figure 3. Early Neolithic lever pressure-flaked blades from southeastern Italy, 1. and 3. Ripa Tetta, 2. and 4. Passo di Corvo (drawings and photographs D. Guilbeau)

### Distinctions between Greece and Italy

The Italian and Greek productions by lever pressure-flaking share several characteristics, such as the choice of very high quality quarried raw materials, the co-existence of flat and faceted butts, the straight or only slightly curved profiles and a high level of craftsmanship. However, they differ in other aspects: the Italian blades, after the initial phase, tend to be lighter, with a high ratio width to thickness, and to present a more thorough preparation on the dorsal face. Copper may have been used earlier in Italy than in Greece for the tip of the crutch: the platform of the blades tends to be very small and often exhibits a small crack (see Guilbeau 2010: 26, vol. 3; Pelegrin 2012a: fig. 18.19). Most significantly, there is no evidence in Greece that exploitation of the macro-cores was initiated by lever pressure and completed by standing pressure. The smaller pressure-flaked blades tend to be made on a variety of homogeneous flints different from the ones used for lever pressure-flaking. The closest parallels between the two regions thus concern the very earliest phase of long blade production, in the Archaic Impressed phase, and may indicate a common

origin of these specialist flint knappers. Later on, the Italian and Greek productions developed their own idiosyncratic styles.

## The origins of lever pressure

The introduction of pressure-flaked blades in Greece and Italy is not synchronous but, in both areas, they seem to appear at the beginning of the Neolithic together with the whole 'Neolithic package': permanent architecture, domesticated plants and animals, pottery, polished stone, etc. There is no antecedent to lever pressure in the microlithic assemblages that characterise the Mesolithic in the two areas or even, in Greece, for standing pressure-flaking (Perlès 1990). Independent local invention of such a complex technique can be ruled out. As stated by Pelegrin (2012a: 493–496), only experienced knappers who had efficiently mastered standing pressure could learn the lever technique through observation. Both standing pressure and lever pressure must have been introduced by the colonists that settled in Greece and southern Italy, and whose Anatolian or Near Eastern origins can no longer be disputed (Paschou *et al.* 2014; Olalde *et al.* 2015; Omrak *et al.* 2016). However, their precise origins and the routes that they followed still escape us. Yet, because pressure-flaking with a lever is such a highly characteristic technique, it could potentially help to define the origins of these groups more precisely.

The earliest identification of the use of lever pressure in Anatolia comes from Çayönü (Binder 2007), for large obsidian blades imported from the Bingöl or Nemrut Dağ outcrops in eastern Anatolia (Altınbilek-Algül *et al.* 2012). It appears in the Late Cell Phase (ca 7500–7250 cal. BC) and persists through the Pottery Neolithic phase. The technique was also identified, a millennium later, at Sabi Abyad 1 in Syria, on imported obsidian blades produced with similar raw materials and techniques to the Çayönü blades (Altınbilek-Algül *et al.* 2012). Given its location, the workshop that supplied Çayönü cannot be considered as a direct source for European Early Neolithic (lever) pressure-flaking. We should, thus, expect to find some milestones on the southern Anatolian coast, or in central and western Anatolia.

On the southern Anatolian coast lever pressure-flaking may be present at Mersin-Yumuktepe, but in the Chalcolithic, thus later than the Greek and Italian Early Neolithic (Baykal-Seeher 1996: 114). On the west coast, it is suspected at Çukuriçi, south of İzmir, on the basis of flint blades just over 20mm wide and obsidian blades just over 26mm wide (Horejs *et al.* 2015: 315). So far, they are attested only during the latest phase of the Neolithic, at the beginning of the 6th millennium, i.e. later than those found in

Greece (Milić this volume). Lever pressure technique is probably present at Uğurlu on Gökçeada Island at the same period, but here again only short blade segments have been recovered and the designation remains to be fully confirmed (Guilbeau & Erdoğu 2011; and *pers. obs.*) We found no other explicit mention of the use of lever pressure in Anatolia or the Levant for the 7th millennium, but, judging from the publications and some personal observations, it is possibly present in the Lakes region and the Marmara region. For instance, several of the blades published by R. Duru for Kuruçay Level 12 (Burdur Province) strongly suggest pressure-flaking with a lever (Duru 1994: pl. 235.3, 7). Some of the blades published by M. Gurova for Ilıpınar 9 and 10 in the eastern Marmara region appear to be at the limit between modes 4 and 5 (Gurova 2006: pl. 5.12). On the other hand, modes 3 and 4 pressure-flaking are abundantly represented in Anatolia (see for instance Balcı 2011: figs 4.2, 5.5, 6). We can, thus, expect more instances of lever pressure-flaking, even if the number of blades may be small compared to those made with less demanding modes of pressure-flaking.

## Conclusion

Pressure-flaking, under its different variants, has long been considered as a good criterion for the identification of technical traditions and cultural groups, and for migrating with these culture groups in their movements across space and time (Inizan *et al.* 1992; Inizan & Lechevallier 1994; Gomez-Coutouly 2011; Inizan 2012; Gomez-Coutouly & Ponkratova 2016). Among the different modes of pressure-flaking, lever pressure-flaking is the most demanding and the most complex to implement. It allows for the production of long, wide blades, characterised by very regular edges and arises, a straight or slightly curved profile of regular thickness, the absence of marked undulations on the ventral face and their 'lightness', i.e. a high ratio width to thickness. A circular crack on the butt indicates the use of a copper tip but will be absent with an antler tip. A lever becomes necessary to augment the human force when the blades exceed ca 20–22mm in flint and 26–28mm in obsidian, but it can also be used for smaller modules.

Lever pressure is not ubiquitous, even when pressure-flaking is in use. It demands high quality flint, mining techniques, time, energy and skill. Except when it serves prestige-related purposes, as was the case at Varna, its advantages compared with indirect percussion are not obvious (Perlès 2004; Guilbeau 2010; see also Pelegrin 2002: 98 for the Grand-Pressigny blades). In this respect, lever pressure can be considered as a good marker of technical and cultural traditions. For instance, it is present in Greece from

the Initial Neolithic, but it has not yet been recognised in Bulgaria before the Karanovo 6, some two millennia later. Similarly, it is present in southern Italy in the early 6th millennium, but only spreads to central and northern Italy, in different cultural contexts, a few centuries later. It may appear in France as early as the beginning of the 5th millennium (Bassin de Forcalquier) and co-exists during the 4th millennium with other specialised workshops using indirect percussion (Honegger 2006; Renault 2006; Mazzieri 2010; Pons *et al.* 2015; Vaquer & Renault 2015; Binder 2016; Provost *et al.* 2017).

The precise origins of the groups that brought the Neolithic way of life to Greece and Italy are still uncertain. Lever pressure has never been considered in this perspective but is a good candidate to trace movements of populations, since its transmission requires direct observation and training among specialists. Depending on the raw material available, the stabilising device, the nature of the crutch tip, as well as idiosyncratic traditions, the module of the products and technical traits of the production (e.g. particular preparation, angle, size and morphology of the butt) will vary, thus allowing for the identification of specific technical lineages.

Equally relevant to define specific traditions and cultural affiliation is the status of the long blades produced in each context (Roux *et al.* 2013). Do they constitute a production distinct from average blades, or is there a continuum between pressure-flaking with a lever and standing pressure-flaking? When intact, were these long blades used as tools and discarded with the remaining lithic assemblage, or were they deposited in special contexts, such as burials and caches? Were they produced to answer specific functional needs or to answer specific social demands?

To understand the origins of pressure-flaking with a lever in Europe (and there may well be a number of different origins) we need to trace its diffusion from southeastern Anatolia to western Anatolia. To do this we need to identify the specific technical signatures of the different lineages of craftsmen involved, as well as the specific social signatures of the groups that made use of these blades.

## Acknowledgments

We thank our laboratory (UMR 7055) for its continuous support, which allowed D.G.'s work in Italy and Dalmatia and our participation in the symposium.

## Bibliography

Abbès, F. 2013: Quelques réflexions sur les débitages de lames de silex par pression, *Archéorient le blog* (Hypothèses.org.) 27 Septembre 2013, <http://archeorient.hypothèses.org/1672>

Altınbilek-Algöl, C., L. Astruc, D. Binder & J. Pelegrin 2012: Pressure blade production with a lever in the Early and Late Neolithic of the Near East, in P.M. Desrosiers (ed), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*, 157–179, New York

Astruc, L., B. Gratuze, J. Pelegrin & P. Akkermans 2007: From production to use: a parcel of obsidian bladelets at Sabi Abyad II, in L. Astruc, D. Binder & F. Briois (eds), *Technical Systems and Near Eastern PPN Communities. Proceedings of the 5th Workshop on PPN Chipped Stone Industries, Fréjus 2004*, 343–355, Antibes

Balçı, S. 2001: The chipped stone industry of Aktopraklık C (Bursa), *Anatolica Antiqua* 19, 1–11

Baykal-Seeher, A. 1996: Die lithischen der aufnahme und auswertung, in M. Korfmann (ed), *Demircihüyük IV, die Ergebnisse der Ausgrabungen 1975–1978*, 7–206, Mainz

Binder, D. 2007: PPN pressure technology. Views from Anatolia, in L. Astruc, D. Binder & F. Briois (eds), *Systèmes techniques et communautés du néolithique précéramique au Proche-Orient. Actes du 5e colloque international, Fréjus, 2004*, 235–243, Antibes

Binder, D. 2016: Approvisionnement et gestion des outillages lithiques au Néolithique. L'exemple de Giribaldi en Provence orientale, in A. Tomasso, D. Binder, G. Martino, G. Porraz, P. Simon & N. Naudinot (eds), *Ressources lithiques, productions et transferts entre Alpes et Méditerranée. Actes de la séance de la Société Préhistorique Française, Nice 2013*, 289–311, Paris

Brusić, Z. 2008: *Pokrovnik—Naselje iz Neolitika*, Šibenik

Cipolloni, M. 2002: Rendina, in M.A. Fugazzola Delpino, A. Pessina & V. Tiné, *Le ceramiche impresse nel Neolitico antico, Italia e Mediterraneo*, 667–676, Rome

Collina, C. 2016: *Le Néolithique ancien en Italie du sud. Évolution des industries lithiques entre 7e et 6e millénaires*, Oxford

Crabtree, D.E. 1968: Mesoamerican polyhedral cores and prismatic blades, *American Antiquity* 33.4, 446–478

Duru, R. 1994: *Kuruçay Höyük 1. Results of the Excavations 1978–1988. The Neolithic and Early Chalcolithic Periods*, Ankara

Galiberti, A. 2005: *Defensola. Una miniera di selce di 7000 anni fa*, Siena

Galiberti, A. 2011: *Defensola A/Miniera One*, in M. Tarantini & A. Galiberti (eds), *Le miniere di selce del Gargano, 6–3 Millennio a.C. Alle origini della storia mineraria Europea*, 135–146, Borgo

Gomez-Coutouly, Y.A. 2011: Industries à composante lamellaire par pression du nord Pacifique de la



- fin du Pleistocène au début de l'Holocène, de la diffusion d'une technique en Extrême-Orient au peuplement initial du Nouveau Monde. Thèse de Doctorat, Université Paris Ouest Nanterre La Défense
- Gomez-Coutouly, Y.A. & I.Y. Ponkratova 2016: The Late Pleistocene microblade component of Ushki lake (Kamtchatka, Russian Far East), *PaleoAmerica* 2016, 1–29, doi:10.1080/20555563.2016.1202722
- Guilbeau, D. 2010: Les grandes lames et les poignards en silex du Néolithique en Italie et dans les îles centro-méditerranéennes: quelle homogénéité ? Thèse de Doctorat, Université Paris 10
- Guilbeau, D. 2011: Le début du Néolithique en Italie méridionale: ce que nous disent les productions en silex du Gargano, *Origini* 33, *Nuova Serie* 5, 83–106
- Guilbeau, D. & B. Erdoğu 2011: Des "lames de Karanovo" dans le site Néolithique d'Uğurlu (île de Gökçeada, Turquie), *Bulletin de Correspondance Hellénique* 135, 1–19
- Gurova, M. 2006: Functional aspects of the early Neolithic flint assemblages from Bulgaria and NW Anatolia, in I. Gatsov & H. Schwarzberg (eds), *Aegean—Marmara—Black Sea: The Present State of Research on the Early Neolithic*, 157–173, Langenweissbach
- Gurova, M., P. Andreeva, E. Stefanova, Y. Stefanov, M. Kočić & D. Borić 2016: Flint raw material transfers in the prehistoric Lower Danube Basin. An integrated analytical approach, *Journal of Archaeological Science, Reports* 5, 422–441
- Honegger, M. 2006: Grandes lames et poignards dans le Néolithique final du nord des Alpes, in *La fin de l'âge de pierre en Europe du Sud : matériaux et productions lithiques taillées remarquables dans le Néolithique et le Chalcolithique du sud de l'Europe*, 43–55, Toulouse
- Horejs, B., B. Milić, F. Ostmann, U. Thanheiser, B. Weninger & A. Galik 2015: The Aegean in the early 7th millennium BC. Maritime networks and colonisation, *Journal of World Prehistory* 28, 289–330
- Inizan, M.L. 2012: Pressure *débitage* in the Old World. Forerunners, researchers, geopolitics—handing on the baton, in P.M. Desrosiers (ed), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*, 11–42, New York
- Inizan, M.L. & M. Lechevallier 1994: L'adoption du débitage laminaire par pression au Proche-Orient, in G.H. Gebel & S.K. Kozłowski (eds), *Neolithic Chipped Stone Industries of the Fertile Crescent. Proceedings of the first Workshop on PPN Chipped Lithic Industries (Studies in Early Near Eastern Production, Subsistence, and Environment 1)*, 23–31, Berlin
- Inizan, M.L., M. Lechevallier & P. Plumet 1992: A technological marker of the penetration into North America. Pressure microblade *débitage*, in P.B. Vandiver, J.R. Druzik, G. Segan Wheeler & I.C. Freestone (eds), *Materials Issues in Art and Archaeology III (Materials Research Society Symposium Proceedings 267)*, 661–667, Cambridge
- Kelterborn, P. 2012: Measurable flintknapping for long pressure blades, in P.M. Desrosiers (ed), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*, 501–519, New York
- Korona, M. 2009: Kremeni artefakti, in B. Marijanović (ed), *Crno Vrilo 2*, 145–218, Zadar
- Manolakakis, L. 2005: *Les industries lithiques énéolithiques de Bulgarie (Internationale Archäologie 88)*, Leidorf
- Manolakakis, L. 2006: Les très grands lames de Varna (Bulgarie): quelle fonction ?, in J. Vaquer & F. Briois (eds), *La fin de l'Âge de pierre en Europe du sud. Matériaux et productions lithiques taillées remarquables dans le Néolithique et le Chalcolithique du sud de l'Europe (Éditions des Archives d'Écologie Préhistorique)*, 5–23, Toulouse
- Mazzieri, P. 2010: *I siti di Via Spezia (Beneficio e Via Guidorossi) et Pontetaro a Parma nel quadro della cultura dei Vasi a Bocca Ouadrata in Emilia Occidentale, Tesi di dottorato*, Pisa
- Mazzucco, N., D. Guilbeau, S. Kačar, E. Podrug, S. Forenbaher, D. Radić & A.M.T. Moore 2018: The time is ripe for a change. The evolution of harvesting technologies in central Dalmatia during the Neolithic period (6th millennium cal. BC), *Journal of Anthropological Archaeology*, <https://doi.org/10.1016/j.jaa.2018.06.003>
- Milojčić, V., J. Boessneck & M. Hopf 1962: *Die deutschen Ausgrabungen auf der Argissa-Magula in Thessalien, 1. Das präkeramische Neolithikum sowie die Tier- und Pflanzenreste (Beiträge zur ur- und frühgeschichtlichen Archäologie des Mittelmeer-Kulturreumes 2)*, Bonn
- Olalde, I., H. Schroeder, M. Sandoval-Velasco, L. Vinner, I. Lobón, O. Ramirez, S. Civit, P. García Borja, C. Salazar-García, S. Talamo, J.M. Fullola, F.X. Oms, M. Pedro, P. Martínez, M. Sanz, J. Daura, J. Zilhão T. Marquès-Bonet, M.T.P. Gilert & C. Lalueza-Fox 2015: A common genetic origin for early farmers from Mediterranean cardial and central European LBK cultures, *Molecular Biology and Evolution* 32.12, 3132–3142
- Omtrak, A., T. Günther, C. Valdiosera, E.M. Svensson, H. Malmström, H. Kiesewetter, W. Aylward, J. Storá, M. Jakobsson & A. Götherström 2016: Genomic evidence establishes Anatolia as the source of the European Neolithic gene pool, *Current Biology* 26.2, 270–275
- Paschou, P., P. Drineas, E. Yannaki, A. Razou, K. Kanaki, F. Tsetsos, S.S. Padmanabhuni, M.

- Michalodimitrakakis, M.C. Renda, S. Pavolovic, A. Anagnostopoulos, J.A. Stamatoyannopoulos, K.K. Kidd & G. Stamatoyannopoulos 2014: Maritime route of colonization of Europe, *PNAS*, [www.pnas.org/cgi/doi/10.1073/pnas.1320811111](http://www.pnas.org/cgi/doi/10.1073/pnas.1320811111)
- Pelegrin, J. 1988: Débitage expérimental par pression. Du plus petit au plus grand, in J. Tixier (ed), *Technologie préhistorique (Notes et monographies techniques du CRA 25)*, 37–53, Valbonne
- Pelegrin, J. 2002: La production des grandes lames de silex du Grand-Pressigny, in J. Guilaine (ed), *Matériaux, production et circulation du Néolithique à l'Âge du Bronze*, 131–148, Paris
- Pelegrin, J. 2004: Photographies et commentaires, in C. Perlès (ed), *Les industries lithiques taillées de Franchthi Tome 3. Du Néolithique ancien au Néolithique final (Excavations at Franchthi Cave, Greece, fasc. 13)*, 28–29, Bloomington
- Pelegrin, J. 2006: Long blade technology in the Old World. An experimental approach and some archaeological results, in J. Appel & K. Knutsson (eds), *Skilled Production and Social Reproduction (Stone Studies 2)*, 37–68, Uppsala
- Pelegrin, J. 2012a: New experimental observations for the characterization of pressure blade production techniques, in P.M. Desrosiers (ed), *The Emergence of Pressure Blade Making. From Origin to Modern Experimentation*, 465–500, New York
- Pelegrin, J. 2012b: Conférence inaugurale. Grandes lames de l'Europe néolithique et alentour, in J.Cl. Marquet & Ch. Verjux (eds), *L'Europe déjà, à la fin des temps préhistoriques, des grandes lames en silex dans toute l'Europe. Actes de la table-ronde internationale, Tours, 2007 (Revue Archéologique du Centre de la France, 38° supplément)*, 15–43
- Perlès, C. 1987 Les industries du Néolithique "précéramique" de Grèce. Nouvelles études, nouvelles interprétations, in S.K. Kozłowski & J.K. Kozłowski (eds), *Chipped Stone Industries of the Early Farming Cultures in Europe*, 19–39, Krakow
- Perlès, C. 1990: *Les industries lithiques taillées de Franchthi. Tome 2. Les industries du Mésolithique et du Néolithique initial (Excavations at Franchthi Cave, Greece, fasc. 5)*, Bloomington
- Perlès, C. 2004: *Les industries lithiques taillées de Franchthi. Tome 3. Du Néolithique ancien au Néolithique final (Excavations at Franchthi Cave, Greece, fasc. 13)*, Bloomington
- Podrug, E., S. McClure, Z. Perhoč & S. Kačar in press: Rašinovac kod ždrapnja (sjeverna Dalmacija) Nalazište ranog neolitika, in *Izdanja Hrvatskog Arheološkog Društva*, Zagreb
- Pons, F., R. Bevilacqua, L. Bruxelles, M. Jarry, V. Léa, H. Martin & J. Vaquer 2015: Le site de Pinot 2 à Blagnac (Haute-Garonne) et le début du Néolithique moyen dans le Sud-Ouest de la France, *Préhistoire du Sud-Ouest* 23, 39–100
- Provost, S., D. Binder, H. Duday, G. Goude, G. Durrenmath, L. Gourichon, D. Castex, C. Dehon, I. Gentile, M. Vuillien & A. Zémour 2017: Les Bréguières (Mougins, Alpes-Maritimes, France), fouilles Maurice Sechter, 1966–1967. Une sépulture collective à la transition des 6ème et 5ème millénaires cal. BC, *Gallia Préhistoire* 57, 289–338
- Reingruber, A. 2005: The Argissa Magoula and the beginning of the Neolithic in Thessaly, in Cl. Lichter (ed), *How did Farming Reach Europe? Anatolian-European Relations from the Second Half of the 7th Through the First Half of the 6th Millennium cal BC (Byzas 2)*, 155–171
- Renault, S. 2006: La production des grandes lames au Néolithique final en Provence. Matériaux exploités, multiplicité des productions, aspects technologiques et chrono-culturels, in J. Vaquer & F. Briois (eds), *La fin de l'âge de pierre en Europe du sud. Matériaux et productions lithiques taillées remarquables dans le Néolithique et le Chalcolithique du sud de l'Europe*, 139–164, Toulouse
- Roux, V., B. Mille & J. Pelegrin 2013: Innovations céramiques, métallurgiques et lithiques au Chalcolithique. Mutations sociales, mutations techniques, in J. Jaubert, N. Fourment & P. Depaepe (eds), *Transitions, ruptures et continuités en préhistoire. Actes du 27th Congrès Préhistorique de France, Bordeaux—Les Eyzies, 2010, Session A*, 61–74, Paris
- Tarantini, M. & A. Galiberti (eds) 2011: *Le miniere du selce del Gargano VI–III millennio a.C. Alle origini della storia mineraria europea. Rassegna di archeologia preistorica e protostorica 24/A 2009–2011*, Firenze
- Tixier, J. 1984: Le débitage par pression, in *Préhistoire de la pierre taillée 2. Économie du débitage laminaire*, 57–70, Paris
- Tozzi, C. 2002: Ripa Tetta, in M.A. Fugazzola Delpino, A. Pessina & V. Tiné (eds), *Le ceramiche impresse nel Neolitico antico, Italia e Mediterraneo*, 579–588, Rome
- Vaquer, J. & S. Renault 2015: Fabrication et diffusion de lames en silex provençaux au Néolithique, in *Réunion des musées nationaux, signes de richesse. Inégalités au Néolithique*, 84–91, Paris
- Volkov, P.V. & E.I. Guiria 1991: Recherche expérimentale sur une technique de débitage, in *25 ans d'études technologiques en préhistoire. Bilan et perspectives. Actes des 9th rencontres internationales d'archéologie et d'histoire d'Antibes*, 379–390, Antibes