Università degli Studi di Ferrara
Dottorato di ricerca in Scienze Umane
Curriculum Quaternario e Preistoria
Ciclo XXIX - Coord. Prof. C. Peretto - S.S.D. L-Ant/01

Université Toulouse - Jean Jaurès
Doctorat de l'Université de Toulouse
Specialité Préhistoire
École doctorale TESC

Doctoral Thesis
Accademic years 2014/2016

Sauveterrian hunter-gatherers in Northern Italy and Southern France

Evolution and dynamics of lithic technical systems

Author:
Davide Visentin

Supervisors:
Federica Fontana
Marco Peresani
Nicolas Valdeyron
Tutor:
Sylvie Philibert

Jury

Fabio Negrino - Ricercatore, Univesità degli Studi di Genova (Italy)
Marco Peresani - Professore associato, Univesità degli Studi di Ferrara (Italy)
Bénédicte Souffi - Responsable d'opération, INRAP (France)
Nicolas Valdeyron - Professeur, Université Toulouse - Jean Jaurès (France)
Annelou van Gijn - Professor, Leiden University (Netherlands)

Reviewers

M. Natividad Fuertes Prieto - Profesor, Universidad de León (Spain)
Grégor Marchand - Directeur de recherche, CNRS (France)

April 12, 2017

Abstract

The Sauveterrian represents one of the main cultural aspects of the European Early Mesolithic. It was at first identified and described in southern France during the 1920ies. Following the discovery of similar lithic assemblages in north-eastern Italy (Adige Valley), during the 1970ies it was proposed that this culture had developed over a large territory whose central areas are represented by southern France and northern Italy. The presumed uniformity of this complex was based, in particular, on the presence in both regions of needle-like backed points (Sauveterre points) and triangular microliths. In the following years a first typological attempt to verify the actual homogeneity of the Early Mesolithic of this region arose some doubts regarding the appropriateness of this unification. Following this line of research the main aim of this work was, thus, to question and verify this association, by applying a broad technological approach to the study of the lithic assemblages belonging to 23 stratigraphic contexts from 12 French and Italian reference sites. More specifically these assemblages were investigated with the aim of reconstructing the entire reduction sequences, from the procurement of lithic raw materials to the use and discard of tools. Different analytical techniques were thus combined in order to understand and characterize the Sauveterrian assemblages from different and complementary viewpoints. Besides, the evaluation of the uniformity of the Sauveterrian complex in its central area with respect to the neighbouring cultural groups, allowed tentatively approaching the investigation of the very nature of western European Early Mesolithic.

Results indicate that both in southern France and northern Italy lithic raw material provisioning was essentially local and, often, based on the exploitation of very different lithologies. Reduction schemes were aimed at obtaining two main dimensional sets of products, although these are not always both attested at the sites. Oversimplifying things, the production of small blanks for the manufacture of microliths as well as of small tool-types is associated to that of large-sized blanks to be used as tools (with or without previous transformation). From a technological point of view, the methods adopted for producing these sets of products are quite similar, being both characterized by short sequences of unidirectional removals, frequent core reorientation, a massive use of flakes as core-blanks and reduced maintenance procedures. At a functional level, sites reflecting the execution of different specific tasks are attested, although cynegetic activities appear omnipresent. In general, the two regions responded to a same conceptual scheme and their respective lithic technical systems shared the same rationale: an extremely optimized technology, not opportunistic in the least, but issued from a careful strategic planning, capable of exploiting differentially the spectrum of available resources and allowing an utter independence of Sauveterrian groups with respect to any constraint related to lithic raw materials. Nonetheless, in the context of this generalized behaviour, a consistent variability can be found, marked by differences of both "stylistic" and technical nature especially regarding the processes for the production of microlithic armatures. This divergence seems most significant in highlighting the presence of, at least, two main areas of influence: a Western Sauveterrian region ("Sauveterrien") and an Eastern Sauveterrian one ("Sauveterriano").

By summarizing, in the context of the important environmental changes that characterized the Lateglacial and Early Holocene, the Sauveterrian technology was fundamental in allowing the development of a complex settlement structure, characterized by a mobility system based on relatively short distances and with a strong logistic component.

Riassunto

Il Sauveterriano rappresenta uno dei principali aspetti culturali del Primo Mesolitico europeo. Fu originariamente identificato e descritto nel sud della Francia negli anni '20 del Novecento. Negli anni '70 in seguito alla scoperta in Italia nord-orientale (Valle dell'Adige) di complessi litici con caratteristiche analoghe, è stato proposto che questa cultura si fosse sviluppata su un ampio territorio le cui aree centrali sono rappresentate dalla Francia meridionale e dall'Italia settentrionale. La presunta uniformità di questo complesso era basata soprattutto sulla presenza, in entrambe le regioni, di punte a dorso aghiformi (cf. Sauveterre) e microliti triangolari. Negli anni successivi un primo tentativo tipologico di verificare l'effettiva omogeneità del Primo Mesolitico di questa regione sollevò alcuni dubbi sulla pertinenza di questa unificazione. Sulla scia di questa linea di ricerca il principale obiettivo di questo lavoro è stato quello di mettere in discussione e verificare tale associazione applicando un approccio tecnologico ampio allo studio dei complessi litici appartenenti a 23 contesti stratigrafici di 12 siti francesi e italiani di riferimento. In particolare, questi insiemi sono stati analizzati con l'obiettivo di ricostruire le intere catene operative, dall'approvvigionamento delle materie prime all'uso e abbandono degli utensili. Sono state integrate diverse tecniche di analisi al fine di comprendere e caratterizzare gli insiemi sauveterriani da punti di vista diversi e complementari. Inoltre, la valutazione dell'uniformità del complesso sauveterriano nella sua area centrale rispetto ai gruppi culturali delle regioni confinanti ha consentito di affrontare in modo preliminare la questione della reale natura del Primo Mesolitico dell'Europa occidentale.

I risultati ottenuti indicano che sia in Francia meridionale che in Italia settentrionale l'approvvigionamento di materie prime era essenzialmente locale e spesso basato sullo sfruttamento di litologie molto varie. Gli schemi operativi erano indirizzati a ottenere due principali categorie di prodotti, sebbene questi non siano sempre entrambi attestati in tutti i siti. Semplificando, la produzione di piccoli supporti per la confezione di microliti e di piccoli strumenti è associata a quella di supporti di grandi dimensioni da utilizzare come strumenti (senza o con precedente trasformazione). Da un punto di vista tecnologico i metodi adottati per produrre queste categorie di prodotti sono simili, essendo entrambi caratterizzati da brevi sequenze di stacchi unidirezionali, frequenti riorientamenti e l'uso massiccio di schegge come nuclei-supporti, oltre che da ridotte procedure di mantenimento. A livello funzionale i siti riflettono lo svolgimento di un ampio spettro di attività specializzate, benché quelle di tipo venatorio siano onnipresenti. In generale le due regioni rispondono agli stessi schemi concettuali e i loro rispettivi sistemi tecnici condividono gli stessi principi: una tecnologia ottimizzata, per nulla opportunistica, bensì risultante da un'attenta pianificazione strategica, in grado di sfruttare in modo differenziato lo spettro di risorse disponibili e di permettere una totale indipendenza dei gruppi sauveterriani dai vincoli imposti dalle materie prime. Tuttavia, nell'ambito di questo comportamento generalizzato, può essere

identificata una notevole variabilità, segnata da differenze di natura stilistica e tecnica, specialmente in rapporto ai processi di produzione delle armature microlitiche. Questa divergenza appare significativa nell'evidenziare la presenza di almeno due aree di influenza: una regione sauveterriana occidentale ("Sauveterrien") e una orientale ("Sauveterriano").

In sintesi, nell'ambito degli importanti cambiamenti ambientali che caratterizzano il Tardoglaciale e l'inizio dell'Olocene, la tecnologia sauveterriana è stata fondamentale nel permettere lo sviluppo di una struttura insediativa complessa, caratterizzata da un sistema di mobilità basato su distanze relativamente brevi e con una forte componente logistica.

Résumé

Le Sauveterrien représente l'une des principales traditions culturelles du Premier Mésolithique européen. Au début, au cours des années '20 du XXème siècle, il fut identifié et décrit pour le sud de la France. Suite à la découverte d'une série d'assemblages lithiques avec des caractères proches dans l'Italie nord-orientale (vallée de l'Adige) pendant les années '70, on a proposé une diffusion sur un territoire ample dont les zones centrales auraient été représentées par la France méridionale et l'Italie septentrionale. L'uniformité présumée de ce complexe était basée surtout sur la présence dans les deux régions de pointes à dos fusiformes (pointes de Sauveterre) et de microlithes triangulaires. Durant les années suivantes, une première tentative typologique de vérifier la réelle homogénéité du Premier Mésolithique de cette région souleva quelques perplexités à propos de la pertinence de cette unification. Suivant cette ligne de recherche, le but principal de ce travail est celui de mettre en discussion et vérifier cette association en utilisant une approche technologique ample des assemblages lithiques appartenant à 23 contextes stratigraphiques de 12 sites français et italiens de référence. En particulier, ces assemblages ont été analysés avec l'objectif de reconstruire les chaînes opératoires dans leur totalité, de l'approvisionnement des matières premières à l'utilisation et à l'abandon des éléments ayant servi comme outils. Plusieurs techniques d'analyse ont été intégrées afin de comprendre et caractériser les assemblages sauveterriens à partir de points de vue différents et complémentaires. De plus, l'évaluation de l'uniformité du complexe sauveterrien dans son territoire central par rapports aux groupes culturels des régions voisines a permis d'aborder de façon préliminaire la question de la réelle nature du Premier Mésolithique de l'Europe occidentale.

Les résultats obtenus indiquent que, dans la France méridionale et dans l'Italie septentrionale, l'approvisionnement en matières premières était essentiellement local et souvent basé sur l'exploitation de lithologies très variées. Les schémas opératoires étaient destinés à obtenir deux principales catégories de produits, bien que celles-ci ne soient pas toujours attestées en même temps dans tous les sites. En simplifiant, la production de petits supports pour la confection de microlithes et de petits outils est associée à celle de supports de grandes dimensions utilisés en tant qu'outils (sans ou avec une transformation précédente). D'un point de vue technologique, les méthodes adoptées pour produire ces catégories de supports sont semblables, les deux étant caractérisées par de brèves séquences d'enlèvements unidirectionnels, de fréquentes réorientations, l'utilisation intensive d'éclats en tant que supports de nucleus et des procédures de gestion limitées. A un niveau fonctionnel, les sites mettent en évidence la présence d'une ample variété d'activités spécialisées, bien que celles cynégétiques soient omniprésentes. En général, les deux régions répondent aux mêmes schémas conceptuels et leurs systèmes techniques partagent les mêmes principes : une technologie optimisée, pas du tout opportuniste, qui résulte d'une planification stratégique précise, à même d'exploiter de façon différenciée le spectre de ressources disponibles et de permettre une indépendance totale des groupes sauveterriens par rapport aux contraintes imposées par les matières premières. Toutefois, dans le cadre de ce comportement généralisé, une certaine variabilité peut être identifiée, indiquée à la fois par des différences de nature stylistique et technique, surtout par rapport aux processus de production des armatures microlithiques. Cette différence parait significative dans la mesure où elle permet de mettre en évidence la présence d'au moins deux aires d'influence : une région sauveterrienne occidentale ("Sauveterrien") et une orientale ("Sauveterriano").

En synthèse, dans le cadre des importants changements environnementaux qui caractérisent la fin du Tardiglaciaire et le début de l'Holocène, la technologie sauveterrienne a joué un rôle fondamental dans le développement d'un réseau d'occupation du territoire complexe, caractérisée par un système de mobilité basé sur des distances relativement brèves et avec une forte composante logistique.

Acknowledgements

First of all I would like to express my sincere gratitude to my supervisors. Thanks to Federica Fontana for her continuous support, guidance and motivation since I first arrived at the University of Ferrara. I am particularly thankful for all the discussion we have had since then. It really represented a priceless time for my personal growth. Thanks to Nicolas Valdeyron for his support during the months spent at Toulouse and for having exhorted me to take on this thesis subject since the first time we worked together at Cuzoul. Thanks to Marco Peresani whose encounter was part of the series of events that led to me joining the University of Ferrara. Thanks to my tutor Sylvie Philibert for all the time and efforts invested in teaching me the bases of use-wear analysis. Her apport was fundamental in the development of this PhD work.

I would also like to thank the two reviewers whose suggestions helped much in improving this work, M. Natividad Fuertes Prieto and Grégor Marchand, as well as the committee members for accepting to review my thesis, Fabio Negrino, Bénédicte Souffi and Annelou Van Gijn.

A heartfelt thanks also goes to all those people that allowed me to study the archaeological series that are the object of this work and provided assistance in accessing the materials. Frédéric Plassard and Morgane Dachary for the assemblages of the Grotte de Rouffignac and their willingness to proofread my writings; Michel Barbaza for allowing me to study the material belonging to his excavation at Fontfaurès, as well as Olivier Gaiffe, Bernard Marty and Frédérique Fantuzzo for welcoming me at the dépôt archéologique - rue Bernard Delicieux at Toulouse; Thomas Perrin for trusting me with the Early Mesolithic assemblages of the Baume de Montclus; Maria Bernabò Brea for allowing and exhorting me to study the materials yielded by the excavations she directed in the Emilian area (Collecchio, Le Mose, Longaròla, Rubbiano); Annamaria Carini for allowing me to access the materials deposited at the Musei civici di Palazzo Farnese, Piacenza; Antonio Dal Lago for the materials of the Grottina dei Covoloni del Broion deposited at the Museo naturalistico archeologico of Vicenza; Ivana De Toni and Caterina Zancanaro for opening me the Museo Archeologico dell'Altopiano dei Sette Comuni Vicentini at Rotzo, Vicenza; Elena Piutti and Vittorio 'Toio' De Savorgnani for the material belonging to Casera Lissandri 17 deposited at the Museo regionale dell'Uomo in Cansiglio "Anna Vieceli" at Pian Osteria, Belluno.

I am also most thankful to Stefano Bertola and Guilhem Constans for their precious aid with raw materials determination and to all those people who helped me with use-wear analysis. In particular I am indebted to Annelou van Gijn for accepting me for a stage period at her laboratory, to Sylvie Beyries as well as to the entire staff of the Stage Tracèo 2015 for their very insightful teachings, to E. Cristiani for the personal lesson on residue analysis and to Sara Ziggiotti for the experimental reference and her precious suggestions.

This research benefited greatly from many stimulating discussions at various conferences and in particular from those held during the MesoLife conference at Selva di Cadore. For this I thank Federica Fontana and Ursula Wierer that co-organized with me the event, as well as all the participants of the conference.

I would like to thank all the folks met during the months spent at Toulouse, for welcoming me, for their aid, their kindness and their friendship: Adriana Soto, Alexandre Angelin, Alizé Hoffmann, Benjamin Marquebielle and Nadia, Camille Bourdier, Caroline Renard, Célia Fat Cheung, Claire Manen, Damien Flas, Elsa Defranould, Emilie Campmas, Esther López-Montalvo, François Bon, François Briois, Gaspard Pagès, Guilhem Constans, Harmonie Béguigné, Inigo Garcia-Martinez de Lagran, Isabelle Carrère, Jean-Baptiste Fourvel, Jean-Marc Pétillon, Jessica Lacarrière, Jessie Cauliez, Joséphine Caro, Josiane Ratsimbazafy, Lars Anderson, Luc Robbiola, Magali Reversat, Marianne Deschamps, Marie-Cécile Soulier, Mathieu Lejay, Michel Barbaza, Nicolas Teyssandier, Nicolas Valdeyron, Patrick Constans, Philippe Boissinot, Philippe Miroux, Pierre Chalard, Sandrine Baron, Sandrine Costamagno, Sonja Kacar, Stéphanie Delaguette, Sylvie Philibert, Thomas Perrin, Unai Perales, Vanessa Léa and Wilfrid Galin.

I am indebted also to the members of the Department of Studi Umanistici of the University of Ferrara and in particular: Antonio 'JJ' Guerreschi, Benedetto Sala, Carlo Peretto, Claudio Berto, Dario Sigari, Elisa Luzi, Federica Fontana, Gabriele Berruti, Irene Valverde Tejedor, Julie Arnaud, Marco Bertolini, Marco Peresani, Maria Chiara Turrini, Marta Arzarello, Matteo Romandini, Stefano Bertola and Ursula Thun Hohenstein.

Finally I would like to thank all the other colleagues and friends for their encouragements, their help, the inspiring conversations and the fun had during these last three years. In particular I thank Alessandro Potì, Carlo Mondini, Cristina De Stefanis, Elisabetta Flor, Fabio Cavulli, Francesco Carrer, Francesco 'QG' Visetta, Giada Rubinato, Giampaolo Dalmeri, Giorgia Patrizi, Giovanna Cremona, Laura Centi, Laure Bassin, Luca Raiteri, Marcel Cornelissen, Marta Modolo, Paolo Beltrame, Paolo Mozzi, Piergiorgio and Nicoletta Cesco Frare, Renzo Corradi, Rossella Duches, Salvo Satta, Sandra Pellizzari, Tiziano Fantuzzi.

A sincere thanks also to all those people that supported me since long before this thesis, that do not care that much about what I wrote in here but still are happy I managed to do it!

This research was supported by the doctoral grant of the Università degli Studi di Ferrara and by the "Bando Vinci 2015 - Capitolo II – Contributi di mobilità per tesi di Dottorato in cotutela (n. C2-76), issued by the Università Italo Francese.

Contents

List of Figures

List of Tables

Preface

Aim of the work

The Sauveterrian represents one of the main cultural aspects of the Early Mesolithic in Europe. Its recognition in Southern France by Coulonges (1928) dates back to the end of the 1920ies. During the 1970ies similar assemblages were identified in North-Eastern Italy (Adige Valley) by Broglio (1971). This evidence, as well as that belonging to the numerous other sites that were investigated in the following years allowed advancing the hypothesis of the existence of a large cultural entity, the Sauveterrian, that developed in southern France and northern Italy during the first part of the Holocene (Kozłowski, 1976; Broglio, 1980; Barbaza et al., 1991). The presumed uniformity of this complex was based, in particular, on the presence in both regions of needle-like backed points and triangular microliths. This association was later questioned by Valdeyron (1994, 2008a) that, still on a typological bases, concluded that the differences between the French and Italian assemblages were too important to allow a formal unification.

Following this line of research, the present work was aimed at questioning and verifying the French *Sauveterrien* - Italian *Sauveterriano* association according to a broad technological approach applied to the lithic assemblages of 23 stratigraphic contexts belonging to 12 different French and Italian sites. The adopted methodology, in particular, aimed at reconstructing the reduction sequences, from the procurement of lithic raw materials to the use and discard of tools. Different analytical techniques were thus combined in order to understand and characterize the Sauveterrian assemblages from different, complementary viewpoints. More specifically the study aimed at reconstructing:

- the raw material procurement strategies with a particular focus on the morphology and quality of collected lithic raw materials in order to assess their possible influence on reduction schemes. This analysis was mostly carried out thanks to the contribution of specialists of the sector;

- the objectives of the production and reduction schemes both as regards unretouched and retouched blanks. This allowed identifying how the different rocks were exploited and comparing the technical knowledge/preferences attested by the studied assemblages;

- the modalities in which tools and microliths functioned, in order to assess the relationship between morpho-typological features and use and infer the functional status of the assemblages. This type of analysis was carried out only for some selected sites (cf. Chapter 3).

Besides, while evaluating the uniformity of the Sauveterrian complex in its central area of diffusion, it was also possible (or better necessary) to compare it with the neighbouring cultural groups, thus investigating the very nature of western European Early Mesolithic.

Structure

The work was structured with an introductory part (Chapters 1 and 2) aimed at presenting , respectively, the geographical and chrono-cultural setting of the investigated area. Chapter 2, in particular, was meant at illustrating the main evidence attributed to the Sauveterrian by highlighting the most relevant peculiarities connected to the chronology and position of the known settlements. In order to contextualize this evidence, brief and synthetic descriptions of the cultural groups that preceded the Sauveterrian in southern France and northern Italy as well as of contemporaneous neighbouring groups were included.

Following a chapter dedicated to the description of the adopted methodology (Chapter 3), the results of studies carried out in the single sites and assemblages were reported. As much as possible in relation to the consistency of the evidence and of obtained data, a similar structure was adopted for all the chapters. Generally in this part a mostly descriptive approach was maintained.

In the discussion chapter data from the single studied sites were compared one another and with available bibliographic references, trying to highlight the differences and similarities that characterize the Early Mesolithic of the studied region. In the final chapter this evidence was contextualized in the scenario of western European Early Mesolithic trying to interpret the nature of the main identified processes and advancing some hypotheses and new perspectives on the inherent features of the so-called "Sauveterrian" across the analysed area thus discussing its variability across time and space and its identity as a uniform cultural complex.

Chapter 1

Regional setting

Contents

1.1 Southern France

From a geomorphological point of view Southern France is characterized by 3 main mountain ridges, the Pyrenees, the Massif Central and the Western Alps, defining 2 large drainage basins: the Garonne-Dordogne (Aquitaine) to the West, flowing into the Atlantic ocean and the Rhône flowing into the Mediterranean sea to the east (Figure 1.1).

As regards political organization, Southern France is subdivided into 4 regions, according to the reform effective from January 2016: Nouvelle-Aquitaine, Occitanie, Auvergne-Rhône-Alpes and Provence-Alpes-Côte d'Azur (Figure 1.2).

The Pyrenees lie East-to-West between the Mediterranean sea and the Atlantic ocean and divide southern France from the Iberian peninsula. To the north this mountain range descends abruptly and almost no foothills are present (Figure 1.3). Northwards the large Aquitaine basin spreads in the area included between the Pyrenees, the Massif Central and the Atlantic ocean. In its mid part runs the river Garonne with its numerous right tributaries.

The Massif Central is a large mountain range mostly consisting of granitic and metamorphic rocks (Figure 1.4). During the Paleogene it was partly interested by the Alpine orogeny. This brought about a strongly asymmetrical profile with a higher uplifting in the south-eastern sector (Cévennes) and, by contrast, less elevated areas towards northwest (Limousin). All along the south-western margin the calcareous plateaus (700-1200 m a.s.l.), known as "*causses*", develop. The rivers and streams originating in the Massif Central and flowing into the Garonne, have cut the plateaus and shaped the current morphology of this region forming deep canyons and gorges. Moreover, all this area is deeply affected by karst phenomena and, as a consequence, is tendentially arid. To the east, a deep cleft that was created by tectonic activities and on which the river Rhône settled its course (known as "*sillon rhodanien*") develops north-to-south, separating the Massif Central from the Western Alps and the Jura. South of the Cèvennes highlands, on the right side of the Rhône, low calcareous

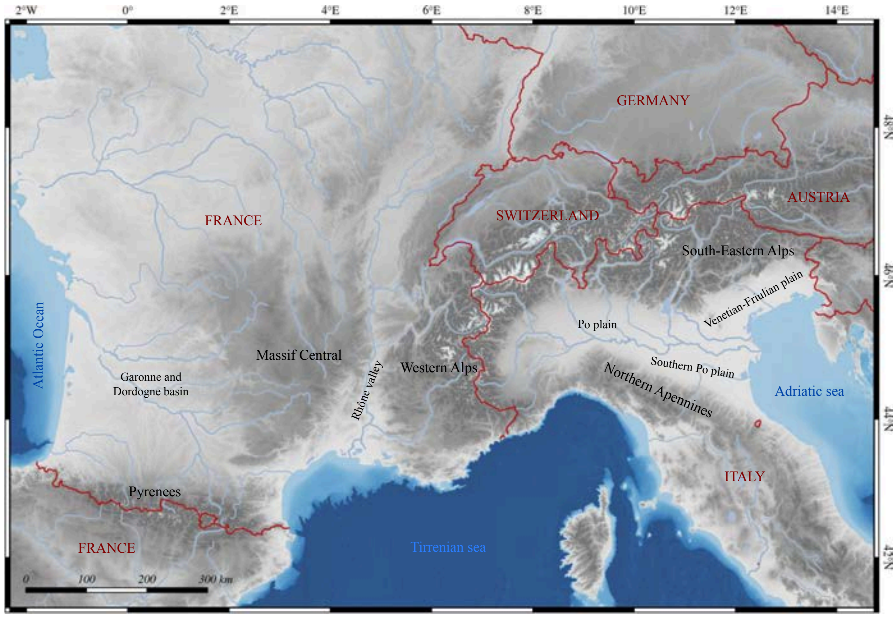

Figure 1.1: Geographical overview on Southern France and North-Eastern Italy.

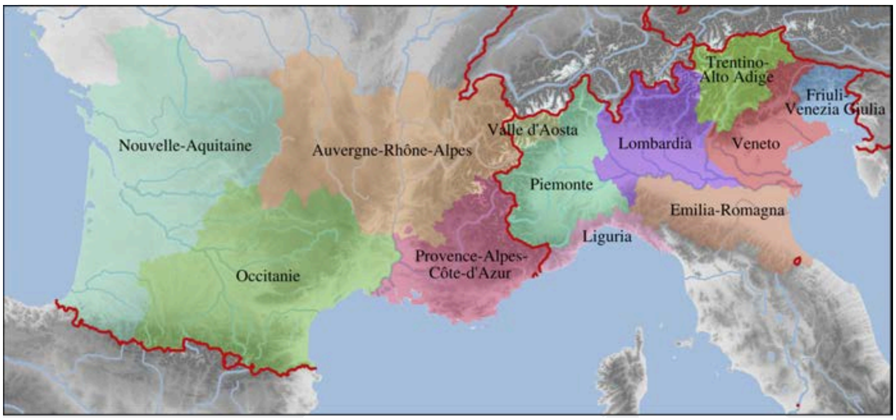

Figure 1.2: Political organization of Southern France and Northern Italy.

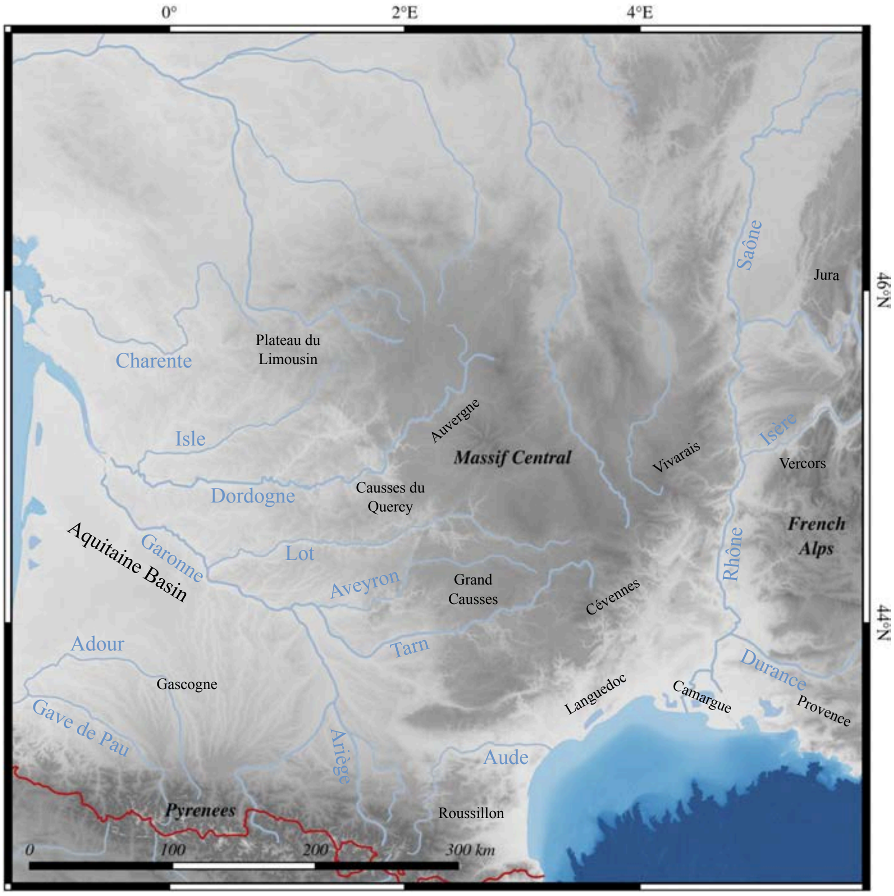

Figure 1.3: Main geographical features of Southern France, with particular reference to the Massif Central and its surroundings.

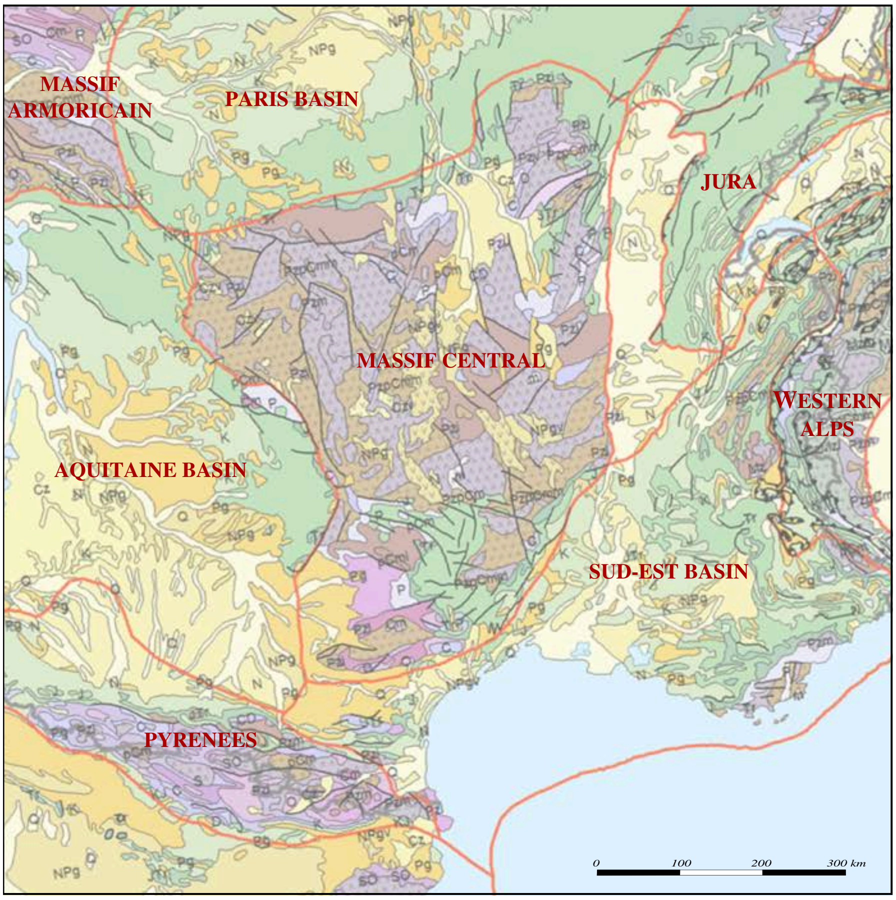

Figure 1.4: Extract from the Geological map of France (available at http://www.cartes-france.fr/).

plateaus are located. Similarly to the *causses* area, also these ones present a developed karstic aspect and deep gorges excavated by rivers and streams such as the Cèze, Gardon, Vidourle and Hérault. More to the south the Rhône divides into two branches and forms the Camargue delta.

Paleoenvironmental data, in particular based on paleoanthracological analysis, indicate that in the *causses* area, although a vegetation characterized by shrubs such as *Juniperus* and *Rhamnus* was dominant, thermophilous taxa were already attested during the Lateglacial, possibly in correlation to the presence of refuge areas of the deciduous oak (Henry et al., 2012). This aspect is common to the entire south-west considering that the association of *Quercus* and *Corylus* is documented at the end of the Pleistocene also in the north-western Pyrenees (Reille and Andrieu, 1995) and in the Rhone valley, where charcoal data record the dominance of *Rosaceae* (Brochier et al., 1991; Delhon et al., 2010). In this period the Massif Central was characterized by a mosaic landscape of open grasslands and clear woodland of pioneering trees. The rapid warming and soil accumulation of the early Holocene provided favourable conditions for the extension of *Betula* and *Pinus* (Miras et al., 2011). At the end of the Preboreal, around 10,500 cal BP, the development of *Quercus* and *Corylus* is attested in the west and east borders of the Massif Central. The oakwoods that developed during the Boreal period in these areas show a high biodiversity including also *Rosaceae*, *Pomoideae*, *Prunoideae* and *Fraxinus*.

Silicified lithic raw materials, in this region, are generally, abundant, in particular all along the foothills of the Pyrenees and of the Massif Central and in the area comprised between this latter and the Western Alps where calcareous formations outcrop more extensively. Furthermore the presence of well developed river systems allowed enhancing the visilibility and dispersion of these resources in the territory.

1.2 North-Eastern Italy

North-Eastern Italy encompasses 4 Italian regions: Veneto, Trentino-Alto Adige, Friuli-Venezia Giulia and Emilia-Romagna (Figure 1.2). From a geographical point of view this territory presents a very high variability, bordering the Adriatic sea and including the eastern sector of the Alpine range, the Venetian-Friulian plain, the eastern portion of the Po plain and the northern watershed of the Northern Apennines (Figure 1.5). This region is crossed in its mid part by the river Po with its numerous southern tributaries originated in the Apennines. Other rivers, such as the Adige, Bacchiglione, Brenta, Piave, Tagliamento and Isonzo, have their source in the South-Eastern Alps and run north-west to south-east, forming the Venetian-Friulian plain and flowing into the Adriatic sea.

At the northern edge of the region, the highland portion is mostly included within the Dolomites, where a Permian to Cretaceous sequence mostly composed of sedimentary rocks, with interbedded volcanic layers, outcrops (Fontana and Visentin, 2016) (Figure 1.6). Towards the south the pre-Alps are formed of Mesozoic and Tertiary sedimentary rocks, mainly limestones, sandstones and pelitic sediments. Some of these formations, in particular the Cretaceous ones, are very rich in cherts. The Piave and Adige represent the main river systems of this area connecting the inner part of the Dolomites and the Venetian plain and present strong similarities as regards their post LGM evolution (Bassetti and Borsato, 2007; Carton et al., 2009; Pellegrini et al., 2006; Ravazzi et al., 2007). During the Late Glacial the reforestation process is well recorded in the pre-Alpine area, on the Cansiglio plateau, by the Palughetto lacustrine and peat sequence (Vescovi et al., 2007). Starting from 16,500 cal BP the pre-Alpine fringe was characterized by open vegetation with *Pinus mugo* scrub and shrub-tundra. Forest vegetation with mainly conifer trees developed on the plateau from around 14,700-13,800 cal BP, while at the beginning of the Holocene pollen data indicate a radical transformation from coniferous dominated forests (*Picea, Larix, Pinus*) to mixed forests with spruce and broad-leaved species (Ravazzi and Vescovi, 2009; Drescher-Schneider, 2009). Since about 9,800 cal BP *Corylus*, *Abies* and *Fagus* started to settle at middle altitudes.

In the mid of the Venetian plain two isolated hill ranges - the Berici and Euganean Hills - are located. While the Berici Hills reach altitudes of around 450 m a.s.l. and are composed of calcareous formations, the Euganean Hills are of volcanic origin and rise to heights of 300 to 600 m a.s.l.

The Venetian-Friulian plain area is characterised by the presence of large alluvial megafans formed by the activity of the main Alpine rivers during the Pleistocene (Mozzi, 2005; Fontana et al., 2008, 2010). These megafans extend from the Southern Alps piedmont area to the present Lagoon of Venice. Their distal parts are less steep than the proximal ones and composed of fine sediments. Marked soil development (*caranto*) took place since the Early Holocene when the oak forest started to extend in the Venetian plain and the lagoon (Carton et al., 2009).

The Southern Po plain area is composed of the sediments deposited during the Holocene by the river Po and its tributaries originating in the inner Emilian Apennines. In particular, the margin of the Emilian Apennines coincides with a complex belt of folded thrust, the "Pede-Apennine Thrust Front", which were active throughout the Quaternary (Cremaschi and Nicosia, 2012). This produced an uplift of the margin of the mountain area and the consequent lowering of the plain in front of it. During the Middle and Upper Pleistocene and in particular in correspondence of Glacial periods the enhanced erosion in the mountain area favoured the formation and successive aggradation of numerous alluvial fans in the piedmont area. Around 12 ka BP the deposition of coarse alluvial sediments was replaced by that of finer deposits. In the mid-Holocene the Apennine rivers had formed suspended well drained channels and covered the plain with their fine overbank sediments (Valloni and Baio, 2008).

The Emilian Apennines develop southeast to northwest and are connected to the Po plain by low terraces created by the fluviatile erosive action and by a low hills belt. The maximum height is reached by Mount Cimone (2,165 m a.s.l.). Numerous transversal valleys connect the main watershed to the Apennine fringe. From a geological point of view this region is characterized by a very complex geological stratigraphy including deep marine and foreland basins formations (flysch) attributable to different palaeogeographic domains: Umbro-Tuscan units (Triassic–Cretaceous), Ligurid ophiolitic units (Jurassic-Cretaceous), Ligurid Flysch units (Paleocene-Eocene) and Epiligurid units (Oligocene-Miocene). In particular in the westernmost sector these formation are rich in silicified raw materials (both cherts and radiolarites), although presenting highly variable quality and knapping suitability.

Between the end of the Pleistocene and the early Holocene, the retreat of glaciers in the Apennines was followed by the expansion of arboreal vegetation. During the Preboreal, the vegetal landscape of the Emilian plain was dominated by pines, mainly Scots pine (*Pinus sylvestris*), followed by fir (*Abies*) and spruce (*Picea*) (Accorsi et al., 1999). From the Boreal onwards, deciduous mixed-oak (*Quercus*) forests spread, often combined with lime (*Tilia*). In the Apennine area, at lower altitudes, mixed broadleaved woods always prevailed, with refuge locations for chestnut (*Castanea*) and walnut (*Juglans*) in the Preboreal and Boreal. Conifers, particularly *Pinus* (accompanied by abundant *Abies*) was the best represented species in mountainous environments from the Preboreal to the Atlantic. Nevertheless the study of some deposits located at mid-high altitudes (1600–1800 m a.s.l.) have shown the local persistence of conditions of low vegetal cover up to the beginning of the Atlantic period (Biagi et al., 1980).

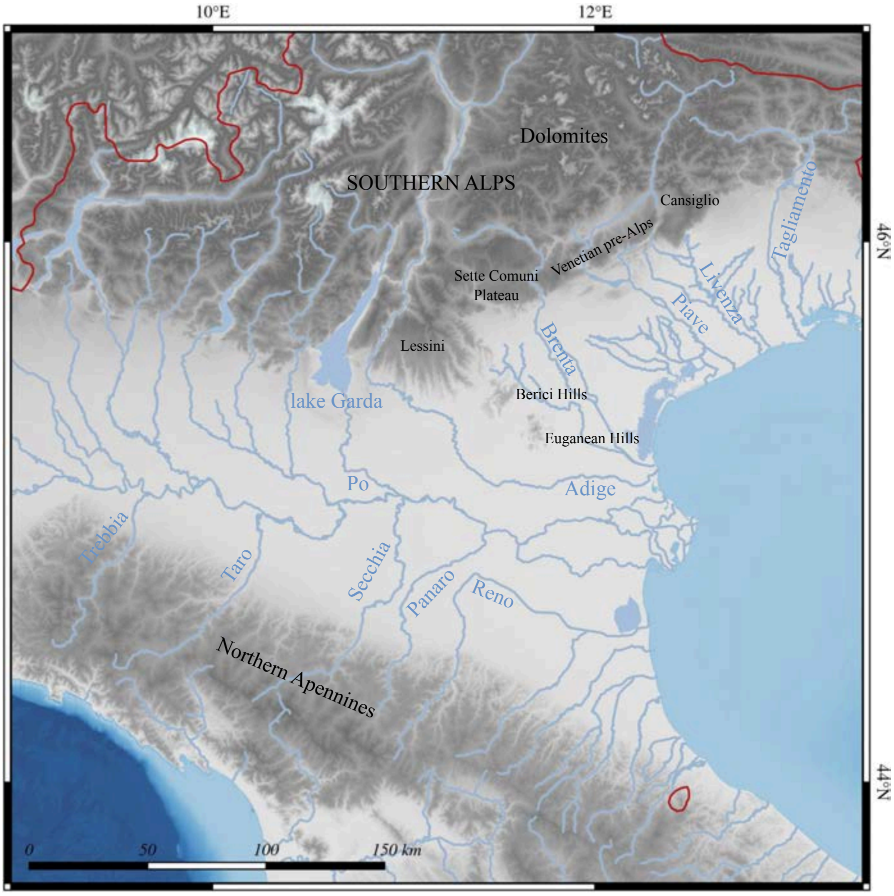

Figure 1.5: Main geographical features of North-Eastern Italy with particular reference to Veneto and Emilia-Romagna.

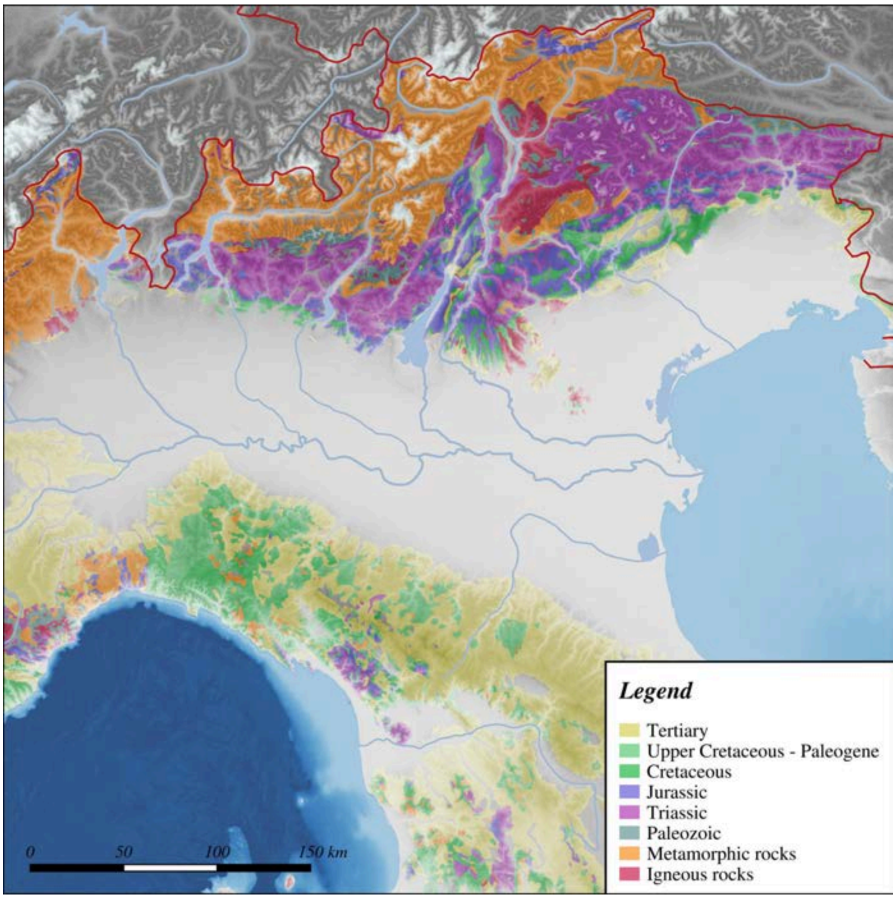

Figure 1.6: Schematic geological overview of Northern Italy. Quaternary covers were not plotted.

Chapter 2

The Sauveterrian in Southern France and Northern Italy

Contents

2.1 Historical perspective

The Sauveterrian culture was at first identified in Southern France during the 1930ies. In particular this discovery is the result of the excavations carried out by L. Coulonge at Le Martinet and Le Roc Allan (in the municipality of Sauveterre-la-Lémance, Lot-et-Garonne, Nouvelle Aquitaine). The author identified a sequence composed of an ancient phase characterized by the presence of small backed bladelets and triangular microliths, followed by a recent one marked by the appearance of trapezes (Coulonges, 1928, 1930). The former was called Sauveterrian while the latter attributed to the Tardenoisian. The same sequence was also confirmed by the excavations of R. Lacam and A. Niederlender at Cuzoul de Gramat (Lacam et al., 1944). Coulonge describes the Sauveterrian industries as characterized by triangular microliths obtained by very small bladelets, with the aid of the microburin technique, associated to small points with retouched edges, different small burins, small end-scrapers, usually circular and flattish, and cores "*à facettes*" (Coulonges, 1954). About the flaking method the author reports: "*Si nous examinons attentivement la technique de taille sur les nuclei sauveterriens, nous observons l'enlèvement désordonné de minuscules éclats irréguliers; les nuclei à lamelles sont très rares et de très petite dimension. Les lames sont mal venues et irrégulières* [...]" (Coulonges, 1954, p. 71). Although not directly mentioned in the descriptions, published tables show the presence of backed points with concave retouched base in addition to the so-called Sauveterre points (Figure 2.1).

In the following years other important Mesolithic sequences were identified and

Figure 2.1: Martinet (Sauveterre-la-Lémance). Artefacts belonging to layer 2 published by Coulonge (1928).

explored, among which: Rouffignac (Barrière, 1972, 1973), Montclus and Châteauneuf-les-Martigues (Escalon De Fonton, 1966). Nonetheless the Mesolithic continued to be seen as a period of regression with respect to the Upper Palaeolithic and Neolithic.

It was only during the 1960ies that things started to change, mainly thanks to the work of J.G. Rozoy that led to the publication of *Les Derniers Chasseurs* in 1978. As regards the study of lithic industries, Rozoy followed the classic typological method of Bordes based on the index fossil approach, but he applied it to the totality of the assemblages. Techno-functional, ethnographic and geographic considerations were also integrated to his study. Rozoy did not adopt the term Mesolithic for referring to early Holocene cultures in Europe, since he thought that this term should be reserved to those regions where this cultural phase really represented a period of transition between the Palaeolithic and the Neolithic. By contrast he thought that the term Epipalaeolithic could better fit the kind of progressive shift that had taken place in Europe. This brought about also the problem of identifying the lower limit of the Epipalaeolithic, that according to Rozoy should not be based on geological/chronological criteria but on "cultural" features. Along with a generalised differentiation of material cultures, the only criterion that he could identify for differentiating Palaeolithic assemblages from Epipalaeolithic ones was the diffusion of microlithization. According to the author Epipaleolithic assemblages were characterised by at least 10% of microlithic armatures. Differences concerning common tools, such as the reduction in the number of burins and the shortening of end-scrapers, were not synchronous in all the analysed regions and, therefore, they could not represent valid parameters. As regards bone industries, points and harpoons disappeared. The timing in which this change was presumed to have taken place is variable, from the beginning of the Allerød in Provence (Valorguien, marked by the presence of fusiform points), to the Younger Dryas in Périgord (appearance of straight backed points and oblique truncated points) and the Early Holocene in most other regions.

At a general level during the early Epipalaeolithic phase, microliths manufactured with oblique truncations became dominant and differentiated. Triangles represent the main type and are particularly attested in south-western France. Common tools include numerous "shapeless" and denticulated retouched flakes. The main differences that characterize the following phase are the decrease of isosceles triangles with respect to scalene ones and the numerical explosion of armatures that reach 70% of retouched pieces. Successively a recent phase marked by the diffusion of trapezes and of the "*style de Montbani*" for the production of laminar and lamellar blanks is attested.

Based on the analysis of several lithic assemblages from France and Belgium, Rozoy identified a high regional and diachronic variability. Such variability is the result of changes in the lithic assemblages that are described as progressive (local continuity in term of population), correlative (inside single cultures) and independent from one culture to the other and in their evolution ("*changement en mosaïque*"). Moreover it should be considered that, according to Rozoy, cultural entities are not close systems. Diffused intercultural phenomena attest to the permeability of single groups' territorial borders and to the circulation of people possibly favoured by pacific relationships and a linguistic uniformity. In the lithic industries these notions are reflected by the fact that single morphotypes are never exclusive but attested in at least 2 or 3 different cultural groups. As regards Southern France, 4 main cultural groups were identified as regards the Early Mesolithic time span: Sauveterrian, Group of the Causses, Montclusian and Montadian Figure 2.2.

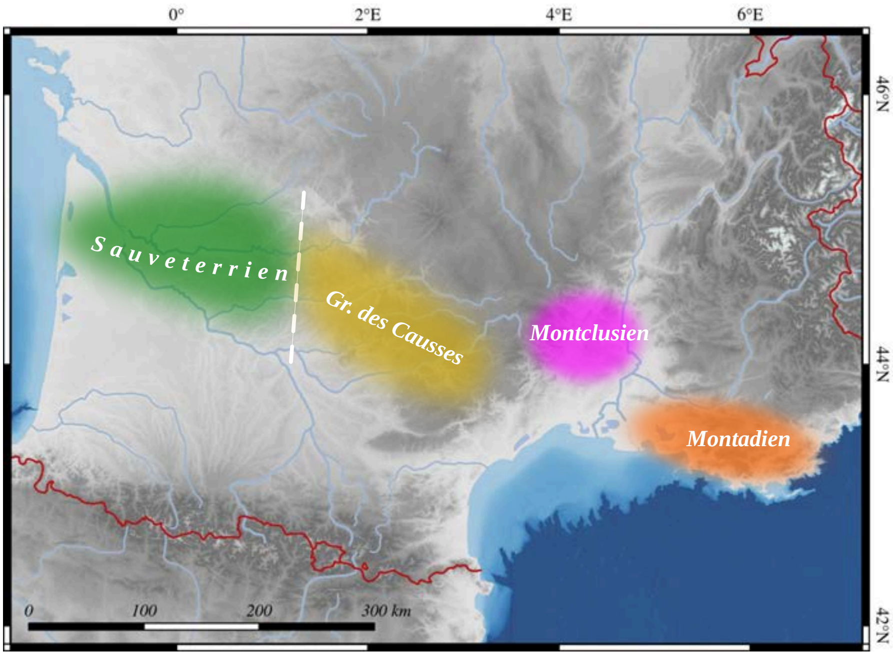

Figure 2.2: Location of the cultural groups identified by Rozoy (1978) in Southern France.

During the same years S.K. Kozłowski developed a larger scale theory regarding the Mesolithic of Europe, based on the notion of "*courants interculturels*" (Kozłowski, 1973, 1975, 1976, 1980). According to the author, Mesolithic lithic assemblages are the summation of a certain number of "fundamental", "marginal" (with a territorial meaning) and "ephemeral" (with a chronological meaning) components. The Sauveterrian component (S) is characterized by small and narrow scalene triangles, triangles with 3 retouched sides, Sauveterre points, small backed bladelets, crescents and the "narrow blade technique" of debitage. Sauveterrian industries are generally exclusively composed of these types of armatures. At the same time, according to Kozłowski, some of these features can be identified also in the lithic assemblages belonging to non-Sauveterrian groups and coming from the territories located north and north-west of the Alps, up to the Great Britain. A similar reasoning was proposed for the Castelnovian component (K) characterized by Montbani bladelets and trapezes. By combining aspects of the composition of lithic assemblages with a spatial and chronological approach the author concluded that Western Europe was divided into 2 main cultural and ecological provinces at the beginning of the Holocene. The first one was represented by the post-Azilian cultures: the Sauveterrian, in Southern France and Northern Italy, and the Beuron-Coincy, between the Paris basin and Moravie. The second included the north-eastern sector of the continent. Around 9700-9300 years cal BP the Sauveterrian trend "exploded" and spread in the northern part of the continent Figure 2.3.

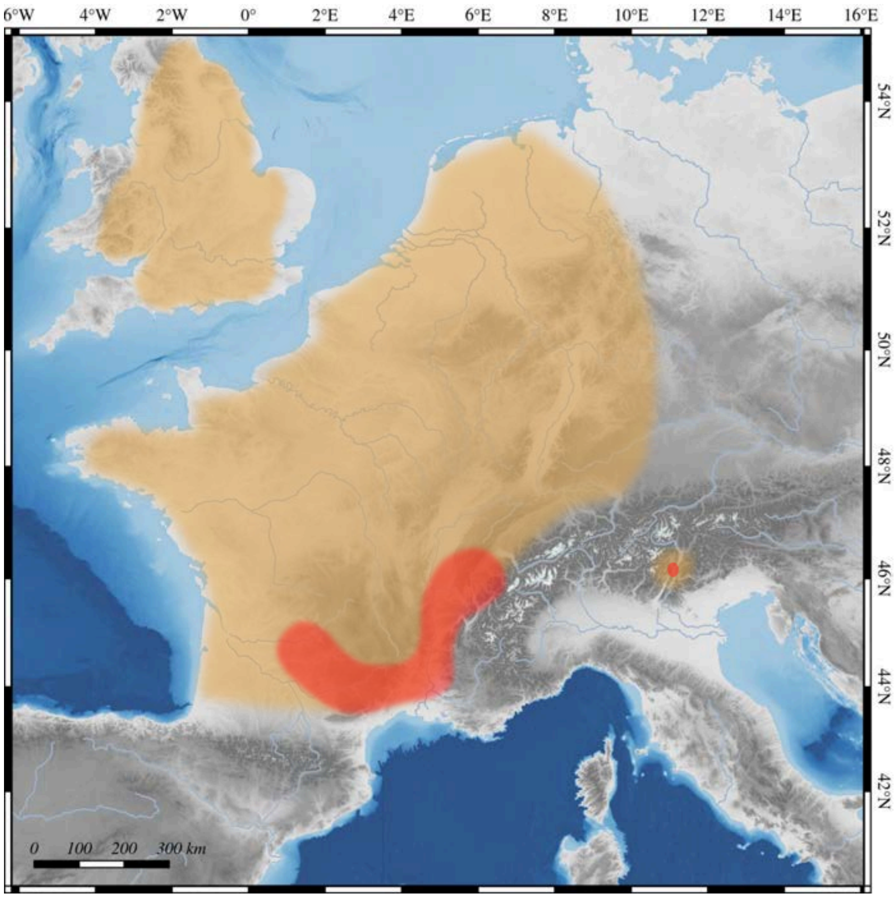

Figure 2.3: Diffusion of the "S" component at the beginning (red) and at the end (orange) of the 9th millennium BP according to Kozłowski (1976).

As regards more closely the Sauveterrian, it should be noted that the author proposed both Southern France and Northern Italy as the area in which it could have originated. In 1968, in fact, some quarry works in the Adige valley, Northern Italy, had brought to light a Mesolithic sequence at Vatte di Zambana (Broglio, 1971, 1976, 1980, 2016). In the following years, 2 other important settlements were identified and excavated in the same area: Romagnano Loc III (1971-1973) and Pradestel (1973-1975). The analysis of these lithic assemblages allowed A. Broglio to attribute to the Sauveterrian the Early Holocene layers and to the Castelnovian the later ones. The unification of these lithic assemblages to those of Southern France was based on typological similarities, in particular of the microlith assemblages (presence of

Sauveterre points, triangles and crescents for the Early Mesolithic levels).

Furthermore the compared study of the 3 assemblages allowed Broglio and Kozłowski to define a typological evolutionary sequence (Broglio, 1980; Broglio and Kozlowski, 1984). As concerns the Sauveterrian 3 different phases were identified: Early, Middle and Late Sauveterrian (Figure 2.4). The older phase is characterized by the presence of triangles, double backed points, backed-and-truncated bladelets, large points with natural base and crescents (in order of importance). Among triangles, isosceles morphotypes are predominant and a high number of them present 3 retouched sides. In the middle phase the percentage of crescents and backed-and-truncated bladelets decreases while that of triangles increases. Among crescents, long and narrow morphologies are predominant and among triangles, scalene types with a short small base. In continuity with the middle phase, the recent one is characterized by long scalene triangles with 3 retouched sides (cf. Montclus triangles) and among double backed points short types with large bases are frequent.

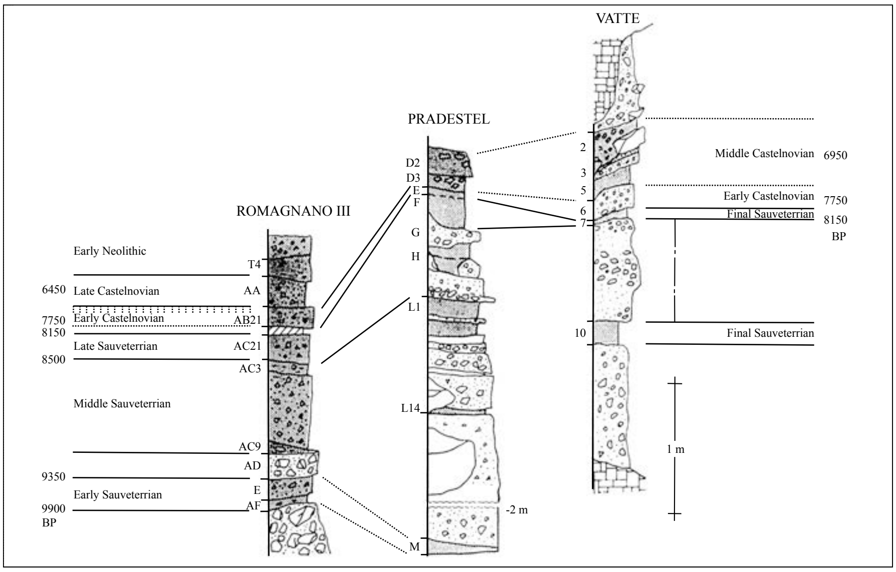

Figure 2.4: Correlation of the Mesolithic sequences of the Adige Valley. Dates are uncal BP (after Broglio 2016).

Going back to Southern France, after the work of Rozoy, the next important step forward in the definition of the Sauveterrian is represented by the excavation of the site of Fontfaurès by M. Barbaza between 1985 and 1987 (Barbaza et al., 1991). The stratigraphic sequence that was brought to light confuted part of Rozoy's model. In particular the study of the lithic assemblages, carried out by N. Valdeyron, showed that the differences between the Classic Sauveterrian, the group of the Causses and the Montclusian did not reflect a territorial diversification but the diachronic evolution of a unique complex and by functional aspects (Barbaza and Valdeyron, 1991; Valdeyron, 1994). The former Epipalaeolithic groups of Southern France were, thus, unified in a large Sauveterrian techno-complex, subdivided into 2 main phases named Early Mesolithic and Middle Mesolithic or Montclusian (readapting one of Rozoy's terms to a chronological signification). During the earliest phase isosceles and ordinary scalene triangles are equally attested in the microlith assemblages along with points with natural base. Then an intermediate phase follows, named "*stade ancien évolué*" and corresponding to the final part of the Preboreal, in which diversified, asymmetric and elongated triangles become dominant. In the latter phase (the "*Sauveterrien montclusien*") triangles shrink to hyper-microlithic dimensions and the *triangles de Montclus*, small scalene triangles featuring a short small base and three retouched sides, gradually replace all other morphologies. The unification of this techno-complex, furthermore, brought Barbaza to recognize the Sauveterrian as "*une aire d'influence cohérente et vaste, étendue depuis au moins le Carso triestin jusqu'à l'estuaire de la Gironde*" (Barbaza et al., 1991, p. 251), in line with what had already been proposed by other authors (e.g. Kozłowski 1976; Broglio 1980). Furthermore, by comparing the Sauveterrian of South-Western France and that of the low Loire valley, Valdeyron (1994) denied the theory of a progressive Sauveterrianisation proposed by Kozłowski (cf. infra) "*dans la mesure où, pour cet auteur, les échanges se font exclusivement dans un sens et traduisent l'attraction exercée par un groupe culturellement dynamique sur un groupe dont l'état de réceptabilité est dicté au contraire par une relative atonie, ce qui n'est manifestement pas le cas pour aucun des deux ensembles considérés*" (Valdeyron, 1994, p. 517). Anyway, it should be pointed out that according to Kozłowski such unidirectionality only concerns the "S" component and not the others.

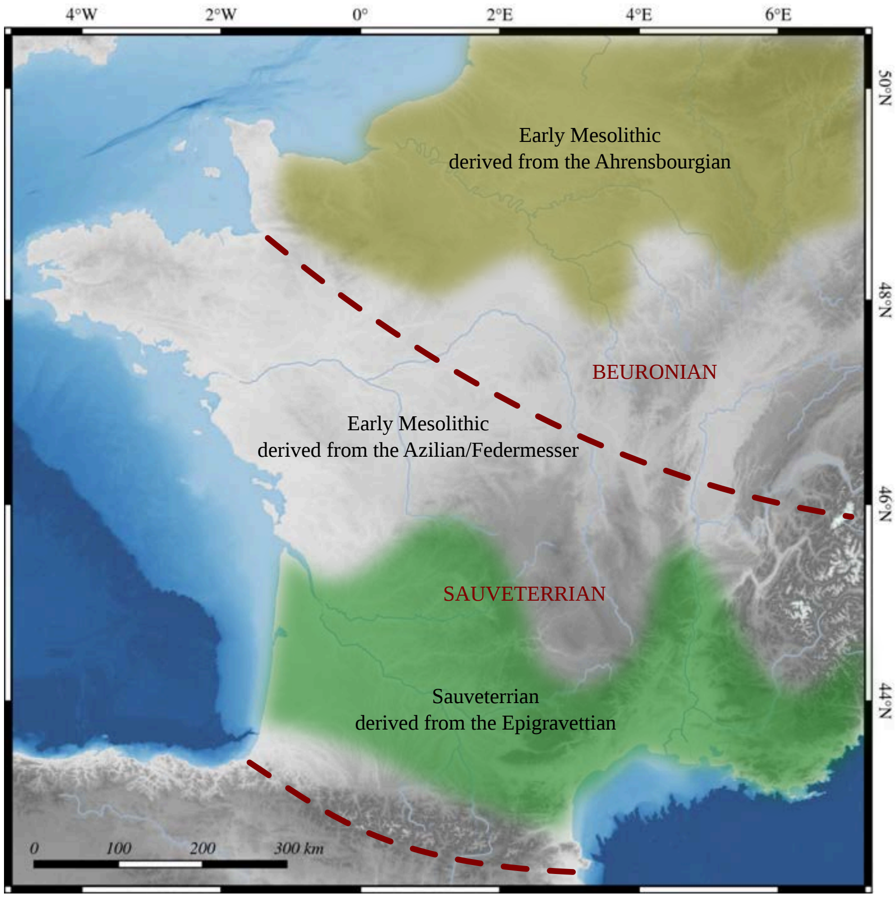

Figure 2.5: The cultural geography of France at the beginning of the Preboreal according to Thévenin (1996, coloured areas) and to Kozłowski (2009, red dashed lines).

During the first half of the 1990ies A. Thévenin developed the hypothesis of the Palaeolithic origin of Mesolithic complexes. In particular he proposed a Preboreal subdivision of France into three main regions. In the southern one the Sauveterrian developed from the Late Epigravettian. In the two mid and northern areas, respectively, the Early Mesolithic developed from the "*groupes à pointes à dos courbe*" (Azilian or Federmesser) and the Ahrensbourgian (Thévenin, 1996, 1999) (Figure 2.5).

As regards the mid-France group that was supposed to derive from the Azilian/Federmesser, his hypothesis implied that Mesolithic crescents derived from Azilian curved backed points (it should be noted that at the time the extension of the Labourian was underestimated). This hypothesis was later rejected by B. Valentin (2006) because of morphological and functional dissimilarities between the two complexes.

In the same years the French and Italian Sauveterrian unity was questioned by N. Valdeyron (1994; 2008a). According to the author "*la distance séparant le Sauveterrien et le Sauveterriano tel qu'il apparaît à Romagnano III [...] semble beaucoup trop importante pour pouvoir conclure à autre chose qu'à une (vague ?) parenté. Il existe de part et d'autre des Alpes toute une série de pièces spécifiques, qui sont apparemment rarissimes ou inexistantes dans l'un des deux ensembles mais très présentes dans l'autre*" (Valdeyron, 2008a, p. 255). Besides, the author advanced the hypothesis of a possible influence of the Italian Sauveterrian on the French one. Such influence was supposed to have been reflected by the habit of retouching the third side of geometric microliths, that possibly originated in Italy and was then "exported" to Southern France. This opening, as highlighted by Valdeyron himself, partially allows reconciling his theory to Kozłowski's. This author, on the contrary, still supports the hypothesis of a unique cultural entity (Kozlowski, 2009) (cf. Figure 2.5).

2.2 Before the Sauveterrian: the Lateglacial cultural complexes of South-Western France and North-Eastern Italy

At the end of the Lateglacial, roughly during the Younger Dryas (12,700-11,550 cal BP), the peopling of western Europe is marked by the presence of different cultural entities. In particular as regards the region of interest of this work, the Laborian and the Late Epigravettian are attested.

The former one is diffused in Southern France from the Pyrenees to the Paris basin and from the Landes to the Western Alps, between 12,500 cal BP and the beginning of the Holocene (Langlais et al., 2014). The Laborian was initially identified by L. Coulonges during the 1950'ies while excavating the cave site of the Borie del Rey (Blanquefort-sur-Briolance, Lot-et-Garonne, Nouvelle-Aquitaine). Considering that he denied the existence of the Azilian, the term was adopted to indicate the transitional levels between the Magdalenian and the Sauveterrian (Coulonges, 1963). With respect to the late Azilian that is characterized by a low standardized debitage system, the Laborian marks a return to a careful exploitation of the raw blocks and to an important laminar production (Fat Cheung et al., 2014; Langlais et al., 2014, 2015). The flaking process was aimed at obtaining both laminar products and smaller bladelets. Large cherty nodules were exploited from two opposite striking platforms, alternatively used for detaching short series of removals. Cores volumetry was frequently maintained and adjusted with frontal and postero-lateral removals. The knapping technique was, presumably the direct percussion with a stone hammer. Bladelet production was achieved either by reduction of blade cores or through dedicated unipolar sequences. The large blades and laminar flakes were destined to the manufacture of domestic tools. These were mostly represented by cutting tools such as truncations and backed knives, burins and end-scrapers. On the other hand, rectilinear small blades were transformed into truncation based backed points (*pointes de la Malaurie*) and right angled bi-truncations (*rectangles*). Furthermore, narrow backed points (*pointes des Blanchères*) were obtained from rectilinear bladelets (Figure 2.6). As regards game, aurochs, horses and red deers were principally hunted along with smaller game. The latest Laborian assemblages, roughly corresponding to the Holocene ones (up to around 11,000 cal BP), are named Epilaborian (Langlais et al., 2014, 2015). As regards lithics, the techno-economic traditions connected to the production of tools from large blades are still valid but the lamellar production increases drastically. This production, as in the previous phase, could result from the reduction of larger cores or from autonomous schemes aimed at the exploitation of small nodules, flakes and block fragments. As regards tools, the main difference with the Laborian is represented by the transformation of small blades into cutting tools by means of a truncation (Figure 2.7). Among armatures, Blanchères points become dominant. At the same time bi-truncated trapezoidal armatures and oblique truncation points appear.

To the East the Laborian/Epilaborian territory adjoins the Late Epigravettian one. The border between the two complexes approximately corresponds to the river Rhône. This cultural group is found on a very large region including Provence and the entire Italian territory, and is thought to have developed also further East, up to Armenia (Montoya et al., 2013). The term Epigravettian was introduced by Laplace (1964b) to describe the assemblages that developed in the Italian peninsula following the LGM. The Epigravettian was subdivided into two main phases: the former one, named Early Epigravettian is characterized by the presence of shouldered points and roughly corresponds to the LGM while the latter, of Lateglacial chronology, is marked by a developed regionalism (Bartolomei et al., 1979; Bietti, 1990; Broglio, 1994; Broglio and Improta, 1995; Palma di Cesnola, 1983). As far as Italy is concerned, the Epigravettian evidence is not evenly distributed (for a synthesis refer to Martini 2007). In the northern part of the country, numerous sites were discovered in the South-Eastern Alpine area, and in the Liguro-Provençal region, while almost none in the other sectors. This distribution is strongly biased by the intensity of research in the different areas. In north-eastern Italy a strong continuity between the different development phases of the Late Epigravettian was highlighted. From a typological point of view, the oldest phase, attested only at Riparo Tagliente and dated to the Older Dryas, is characterized by the presence of long frontal end-scrapers and, among armatures, by the dominance of *microgravettes*, along with backed bladelets, backed-and-truncated bladelets and rare shouldered pieces (Bartolomei et al., 1982). Since the Bølling/Allerød interstadial end-scrapers are mostly represented by short types and backed-and-truncated bladelets become more numerous than *microgravettes* and present a higher morphological variability. For this phase and the following ones the archaeological evidence is much richer. With the Younger Dryas new types of armatures are attested, such as small proximal points with natural bases, bitruncated pieces, crescents and triangles (Figure 2.8) (Broglio, 1973, 1994; Broglio and Improta, 1995; Fontana et al., 2015; Guerreschi, 1975, 1984a, 1996). For these latter the microburin technique starts to be applied. The second part of the Younger Dryas sees the development of the microburin technique and the beginning of the microlithization process of armatures. From a technological point of view a progressive simplification of lithic reduction processes was highlighted (Montoya, 2004; Bertola et al., 2007). Nonetheless during

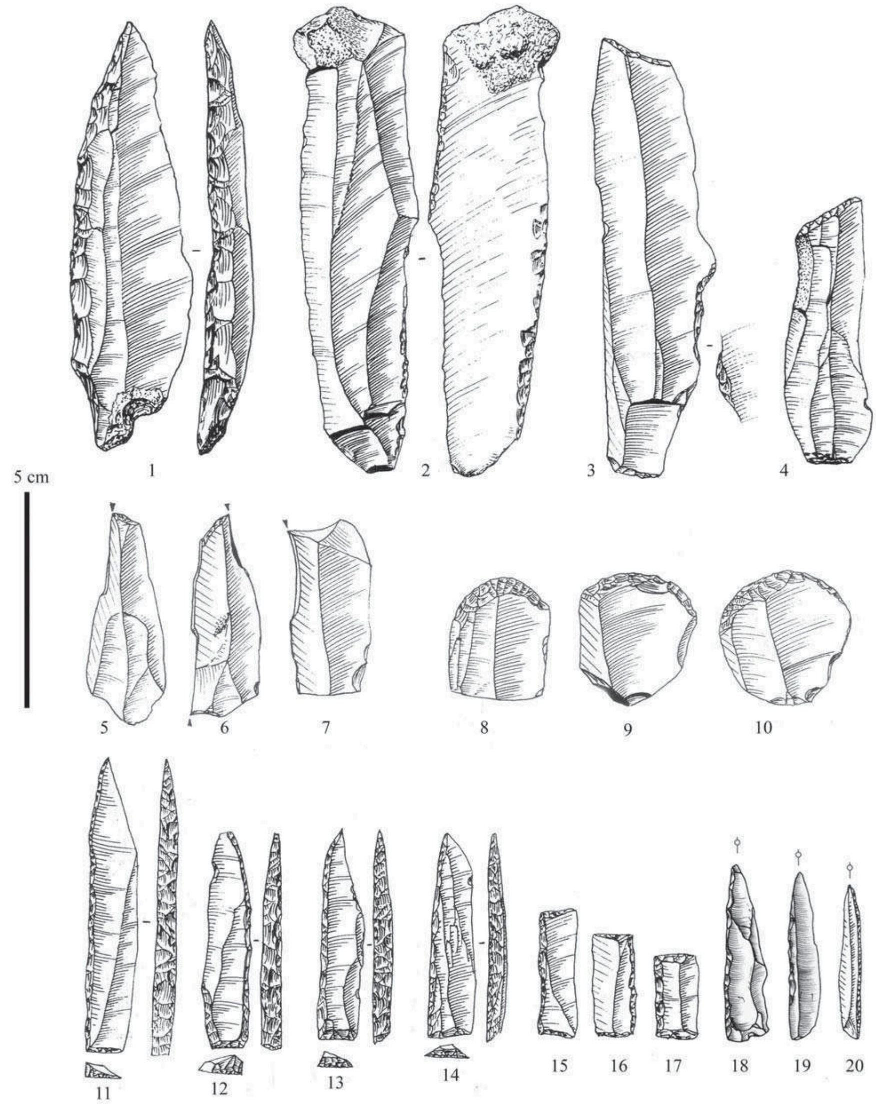

Figure 2.6: La Borie del Rey, Laborian artefacts. 1) backed knife, 2) blade, 3-4) truncated blades, 5-7) burins, 8-10) endscrapers, 11-14) Malaurie points, 15-17) right angled bi-truncations, 18-20) Blanchères points (after Langlais et al., 2014).

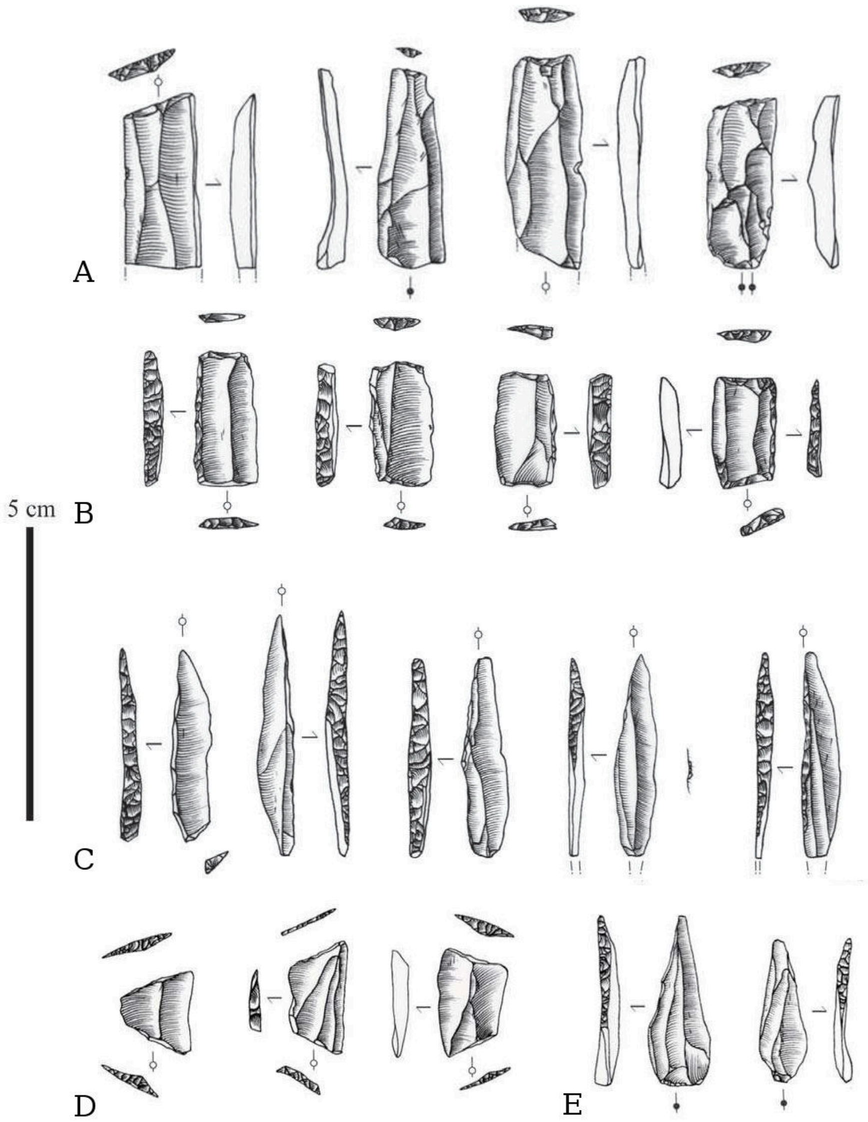

Figure 2.7: La Borie del Rey, Epilaborian artefacts. A) truncated small blades, B) right angled bi-truncations, C) Blanchères points, D) trapezoidal bi-truncations, E) oblique truncation points (after Langlais et al., 2014).

the Younger Dryas a high variability of technical systems is attested. At a general level, the natural morphology of the blocks was exploited for the initialisation of debitage. The presence of a main lamino-lamellar scheme is confirmed by most authors although being often associated to the production of smaller elements from flakes and block fragments. Debitage mostly consisted of unidirectional sequences of removals. More rarely two opposite striking platforms were adopted (Bassetti et al., 2009; Cusinato et al., 2005; Dalmeri et al., 2005a, 2013; Duches et al., 2014; Mussi and Peresani, 2011; Naudinot et al., 2014; Peresani et al., 2000, 2011; Tomasso et al., 2014; Tomasso, 2015; Tozzi and Dini, 2007).

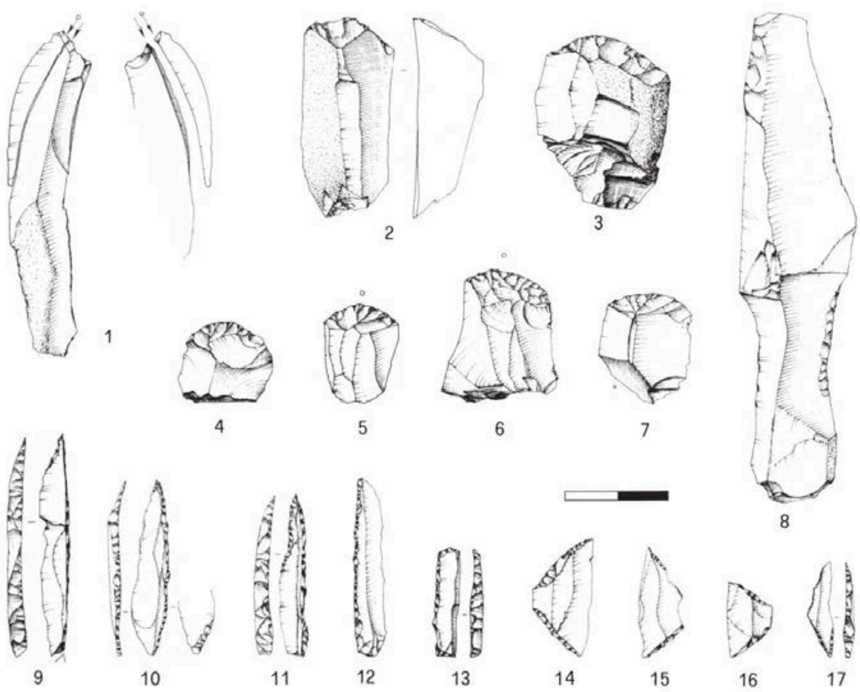

Figure 2.8: Bus de la Lum, Late Epigravettian artefacts. 1) burin, 2-7) end-scrapers, 8) retouched blade, 9-11) backed points, 12) backed bladelet, 13) backed-and-truncated bladelet, 14-16) bi-truncated pieces, 17) triangle (drawings by G. Almerigogna) (after Peresani, 2009).

The excavation and analysis in the 1970'ies of the deposits of Andalo (Figure 2.9) and Piancavallo allowed A. Guerreschi (1984b) to extend this continuous evolutive sequence also to the Sauveterrian assemblages, thus confirming one of the two hypothesis previously advanced by Broglio (1973) regarding the origin of the Mesolithic in North-Eastern Italy. More recently, the Late Epigravettian - Sauveterrian transition was investigated at Riparo La Cogola (Cusinato, 2003; Cusinato et al., 2005). The analysis of the transitional levels (SU 19 and 18), essentially confirmed the idea of a direct origin from Late Epigravettian complexes. In particular, the main trends attested by the sequence are a decrease in the production of laminar products and a gradual reduction of their lengths. A dimensional reduction is attested also by the armature assemblage. Namely the Sauveterrian layer (SU 16) is characterized by a higher number of double backed points, crescents and triangles. Simultaneously also the use of the microburin technique increases drastically.

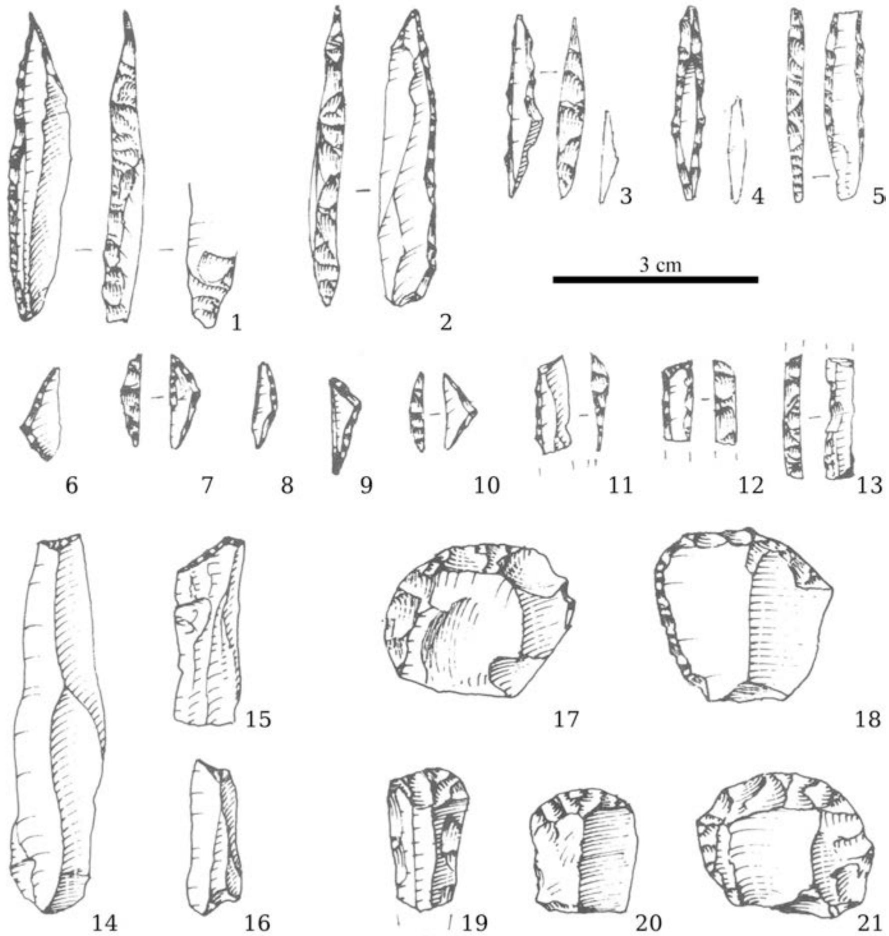

Figure 2.9: Andalo, Late Epigravettian artefacts. 1-4) backed points, 5) double backed bladelet, 6-10) triangles, 11-12) backed-and-truncated bladelets, 13) backed bladelet, 14-16) truncations, 17-21) endscrapers (drawings by G. Almerigogna) (after Guerreschi, 1984a).

2.3 The Early Mesolithic in Western Europe: regional overviews

2.3.1 The main Sauveterrian region

South-Western France

Starting from South-Western France (Figure 2.10), the current Mesolithic evidence shows the presence of an important cluster of sites in correspondence of the plateaus bordering the Massif Central to the South-West. In this area the eponym sites of the Sauveterrian - Martinet and Roc Allan (Coulonges, 1928, 1954, 1930) - are located,

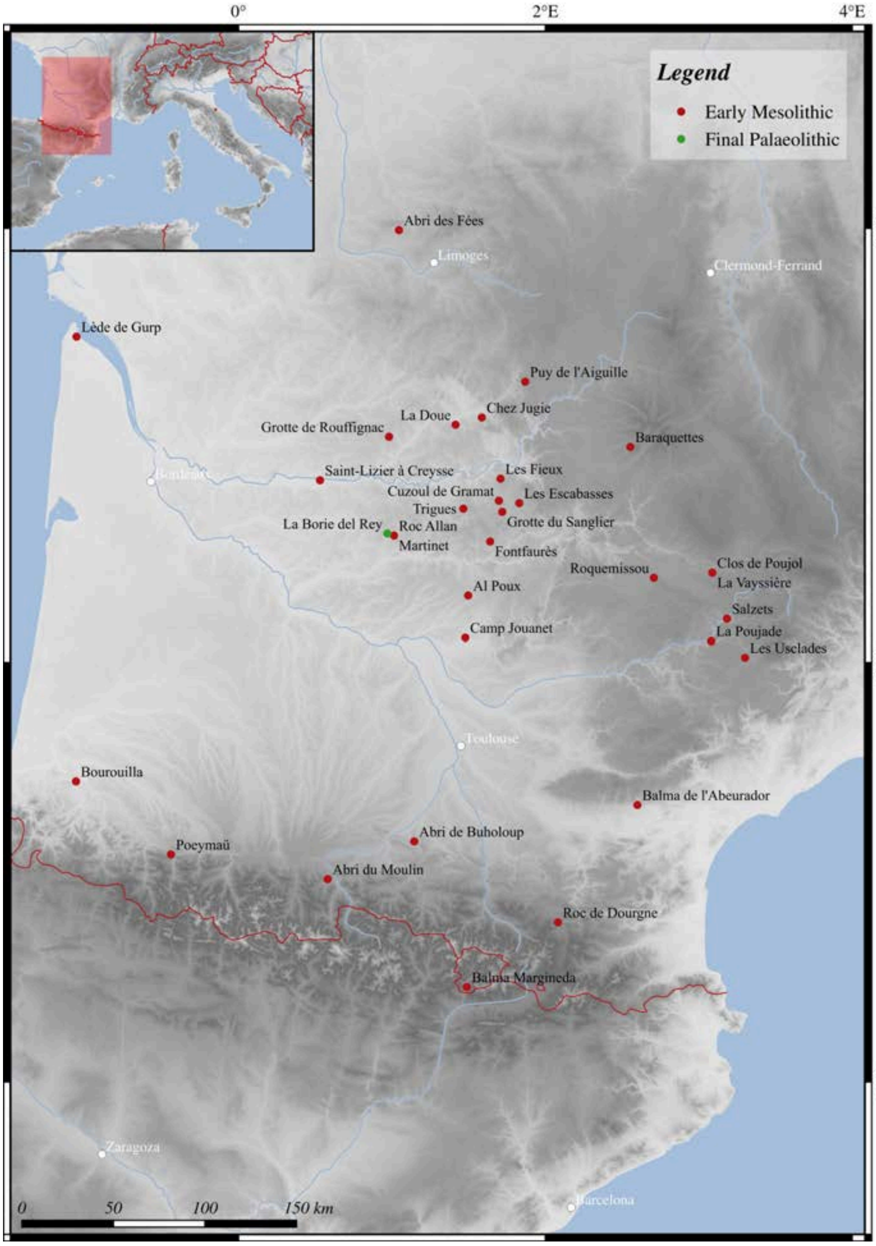

Figure 2.10: South-western France. Location of the mentioned sites.

along with some of the most important sequences of Southern France. Among them Grotte de Rouffignac (Barrière, 1972, 1973), Fontfaurès (Barbaza et al., 1991), Les Fieux (Champagne et al., 1990; Valdeyron et al., 2011), Cuzoul de Gramat (Lacam et al., 1944; Valdeyron et al., 2014), Grotte du Sanglier (Séronie-Vivien, 2001) and Les Escabasses (Valdeyron, 2000; Lorblanchet, 1966). More to the East the sites of Roquemissou (Bobœuf, 2003), Clos de Poujol (Bobœuf and Bridault, 1997), La Vayssière (Bobœuf, 1998), Salzets (Maury and Lacas, 1965) and Les Usclades (Maury, 1997) are found. All of them correspond either to cave or rock-sheltered sites and most of them present lithic assemblages that are dominated by microliths. Studied open-air sites in the area are much rarer and essentially represented by Saint-Lizier à Creysse (Tallet et al., 2013) and Trigues (Valdeyron et al., 2008). The abundance of sites in the Quercy area allowed the reconstruction of a sequence encompassing the entire Mesolithic period (Valdeyron et al., 2008). For the Early Mesolithic phase, the exclusive use of local raw materials is reported. These, mainly, correspond to small/medium sized alluvial cobbles that were flaked with hammerstones. Cores are unidirectional and oriented to the production of thin, narrow and elongated blanks such as short bladelets and small laminar flakes that were destined to the production of microliths. For their manufacture, in particular, the pieces featuring regular ridges and with a low longitudinal convexity were selected. The use of the microburin technique is attested in particular in the earliest phase, while later it almost disappears, in concomitance with the diffusion of Montclus triangles. Use-wear analysis carried out at Fontfaurès and Les Fieux showed that both geometric and non-geometric armatures were used as perforating elements, while only the former were used as lateral implements (Philibert, 2002; Khedhaier, 2003).

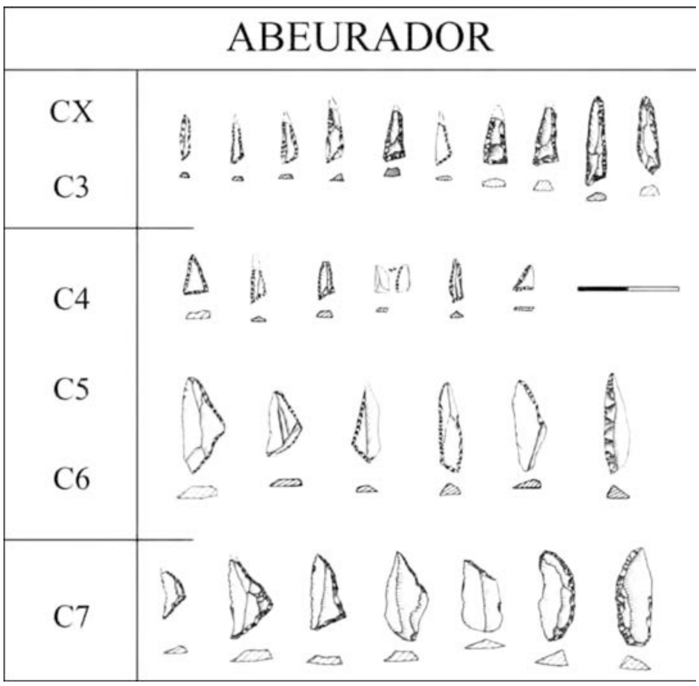

Figure 2.11: Abeurador, evolution of microlithic armatures (drawings by J. Vaquer) (after Vaquer and Ruas, 2009).

Further from the Massif Central in the lower Quercy, two open-air sites were identified and explored during a rescue excavation: Al Poux and Camp de Jouanet (Amiel and Lelouvier, 2003). The former features numerous large combustion structures and was interpreted as a repeatedly occupied temporary site. The latter, because of the high presence of debitage wastes and its location on an alluvial context rich in cherts, is supposed to have been a site dedicated to the processing of lithic raw materials for the manufacture of armatures. Faunal remains, although scarce and poorly preserved, attest the hunting of aurochs and deers. More to the South the lower Aquitaine basin is almost devoid of investigated Mesolithic sites. Numerous cave and rock-sheltered sites were identified also along the Pyrenean foothills. Among them the most important are Bourouilla (Dachary et al., 2013); Poeymaü, Troubat - Abri du Moulin (Barbaza and Heinz, 1992), Abri de Buholoup (Briois and Vaquer, 2009), Balma de l'Abreuador (Vaquer and Ruas, 2009). At a general level these sites yielded lithic industries that are comparable to those of the Quercy sequences (Figure 2.11). Moreover, in the inner part of the Eastern Pyrenees (Andorra) is located the site of Balma Margineda (Philibert, 2002). In all of them hunting and lithic raw material flaking aimed at the production of armatures are among the most attested activities. In the Pyrenean foothill sites, large forest mammals such as red deer and wild boar were generally hunted along with smaller mammals (e.g. beaver at Buholoup) and birds. Additionally, fishing and the collection of land snails and vegetables are also attested. Buholoup, in fact, is considered as a shell midden site. Being located in the inner part of the Pyrenees, Balma Margineda attests the specialized hunting of *Capra ibex*. Considering that this site yielded evidence of the processing of different materials and in particular of hides, it was interpreted as a residential hunting stand (Philibert, 2002), while for the others short-term occupations were proposed.

South-Eastern France

Moving to the western slope of the Rhône basin the most important evidence is represented by the Baume de Montclus, located along the narrow valley of the Cèze (Escalon De Fonton, 1966; Darmedru and Onoratini, 2003; Perrin and Defranould, 2016; Philibert, 2016) (Figure 2.12). To the East of the Rhône the Mesolithic evidence is much richer. As regards Provence the main sites are represented by Le Sansonnet (Guilbert, 2000, 2001, 2003), Gramari ((Paccard et al., 1968), Les Agnels (Guilbert, 2000, 2001, 2003), La Montagne (Onoratini, 1982; Helmer and Monchot, 2006), La Montade and Abri Cornille (Escalon De Fonton, 1966), Pey-de-Durance (Valdeyron, 1994; Guilbert, 2000, 2003) and Baume Fontbrégoua (Jean, 1973, 1975). Some of the Preboreal sites of this area are characterized by the presence of a high number of crescents. This feature along with the early development of microlithization at the end of Pleistocene led M. Escalon de Fonton to identify a local cultural group that he named Montadian (Escalon De Fonton, 1966) after the site of La Montade. Here an assemblage rich in denticulates and devoid of any microlith was identified. By correlating this finding with other sequences (such as Abri Cornille), Escalon de Fonton proposed a local origin of the Montadian from the Romanellian/Valorguian. According to the author, the Montadian lithic assemblages, dated between the Younger Dryas and the Preboreal, are characterized by "*la denticulation des grattoirs et de certains racloirs, la diminution rapide des lames et lamelles à dos qui finissent par disparaître. L'aspect de plus en plus nucléiforme des burins. Une retouche heurtée, scalariforme, écailleuse. Certains racloirs ont une morphologie les rapprochant de certains racloirs appointés du Moustérien. La technique de taille est moustéroïde et presque tous les talons sont facettés. [...] Il s'agit*

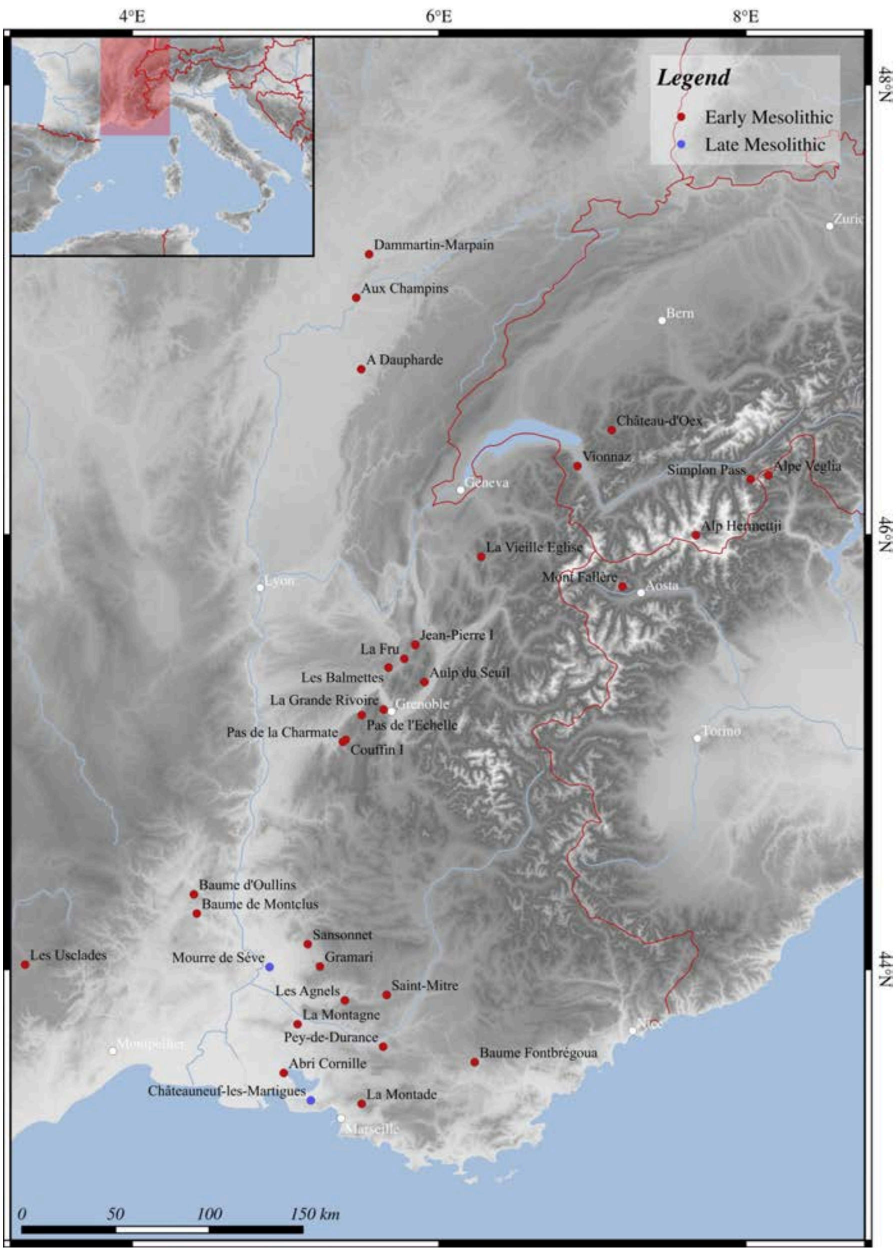

Figure 2.12: South-eastern France, Switzerland and north-western Italy. Location of the mentioned sites.

d'une adaptation à de nouvelles conditions de vie. Au cours de son évolution, le Montadien utilise de plus en plus les microlithes géométriques" (crescents and triangles) (Escalon De Fonton, 1966, p. 148) (Figure 2.13). Furthermore, the Montadian was supposed to have evolved into the Montclusian in the areas far from the seaside such as Montclus, and into the Castelnovian, locally (during the mid-Boreal period). The analysis of three Early Mesolithic sites, Le Sansonnet, Les Agnels and Pey-de-Durance, brought R. Guilbert (2003) to confute this theory. According to this author, the Provence sequence is characterized by the same trends attested in South-Western France. The only difference is believed to be the hyper-microlithic aspect of the lithic assemblages, a feature that is possibly connected to an Italian influence. By contrast with the previously analised regions, the Provençal area includes numerous open-air sites that were the object of detailed studies among which Le Sansonnet, Les Agnels and La Montagne. The latter was interpreted as a seasonal (autumnal) killing/processing site, possibly connected to collective hunting and exploiting the local morphology of the area for driving large mammals (Helmer and Monchot, 2006). Hunted animals are mostly represented by *Bos primigenius*. Other attested species are *Equus hydruntinus*, wild boar, red deer, roe deer, bouquetin, and chamois. Considering the high volume of meat that may be procured seasonally by hunting these animals, the hypothesis of a winter stocking strategy has been proposed. At a general level in Provence the persistence during the entire Early Holocene of *Bos primigenius* and *Equus hydruntinus* is attested by most sites and can be related to the Mediterranean (and more open) local environment. In Liguria, the Italian region adjoining Provence, Early Mesolithic evidence is almost absent but for a few lithic scatters (Maggi and Negrino, 2016).

The Western Alps and pre-Alps

The colonization of the French pre-Alps is attested since the Final Palaeolithic, although settlements are limited to mid-low altitudes (less than 1000 m a.s.l.) (Bintz, 2003). Since the beginning of the Holocene, following a new expansion of the vegetal cover the highlands (up to 2000 m) were colonized. Most evidence is clustered in two pre-Alpine plateaus, where numerous researchers have been active since the 1980ies. Among the most relevant sites are La Grande Rivoire, Pas de l'Échelle, Couffin I and Pas de la Charmate (Angelin et al., 2016; Bintz and Pelletier, 1999) in Vercors and Jean Pierre I, La Fru, Balmettes and Aulp du Seuil in Chartreuse (Bintz and Pelletier, 1999; Monin and Pelletier, 2000; Bintz, 2003; Pion and Thévenin, 2007; Picavet et al., 2014) (Figure 2.12). Further north, in the Bornes Massif, the site of La Vieille Église is found (Ginestet et al., 1984). For this area a chronological division of the Early Mesolithic into three phases was proposed (Bintz and Pelletier, 1999; Angelin et al., 2016). The first phase (11,200-10,500 cal BP), in continuity with the Epipalaeolithic, is only poorly documented. The second phase (10,500-9500 cal BP), corresponding to the beginning of the Middle Mesolithic, is marked by the presence of hyper-microlithic assemblages composed of crescents, isosceles and scalene triangles. These are generally shorter than 10 mm and frequently retouched on 3 sides. The microburin technique is well attested. In the latest phase (9500-8700/8500 cal BP) the debitage becomes more regular and standardized. Among microliths Sauveterre-like points and scalene triangles are dominant and their average dimensions slightly increase. During this phase the microburin technique was no longer adopted.

In the Upper Saône valley, on the Jura massif, two open air sites attest the northernmost limit of the Sauveterrian in this region: Dammartin-Marpan (Séara and Roncin, 2013) and Ruffey-sur-Seille "À Daupharde" (Séara, 2000b,a). The two

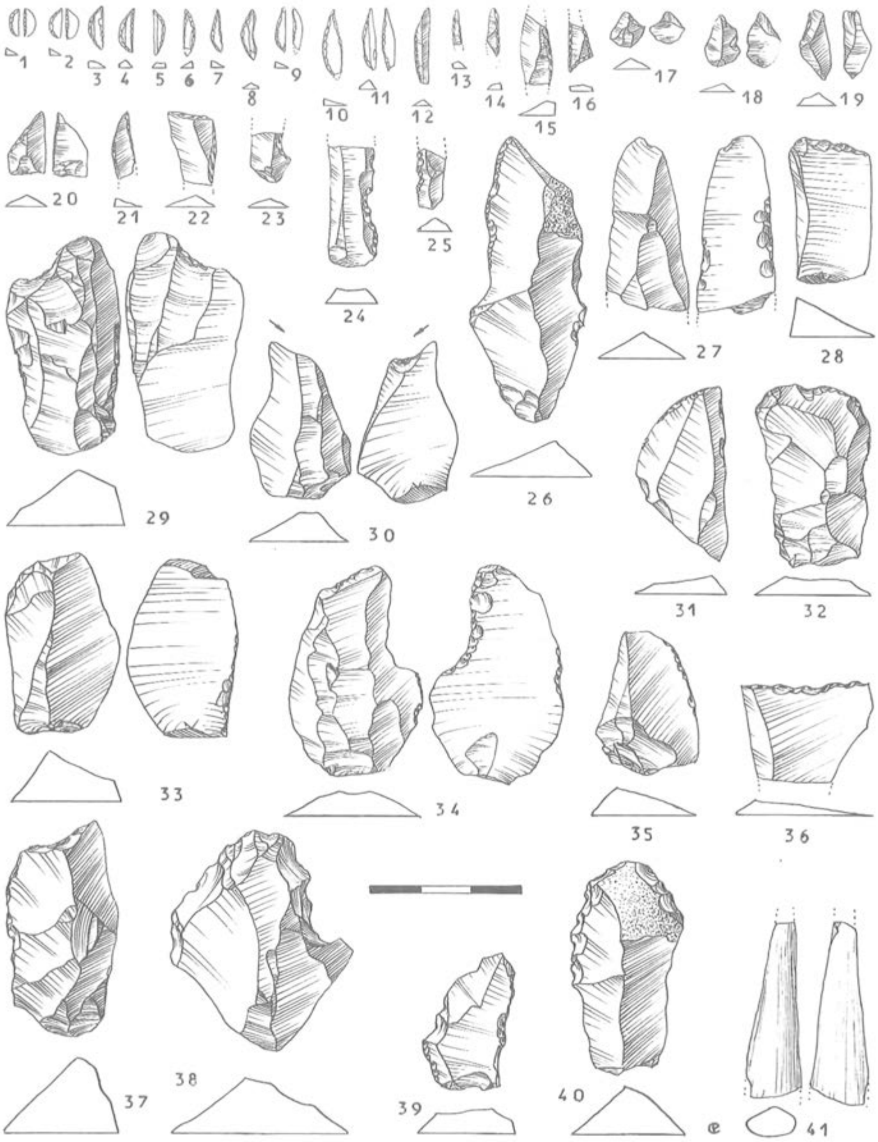

Figure 2.13: Abri Cornille, layer 6. Early Montadian artefacts (drawings by P. Couzy) (after Rozoy, 1978).

sites attest the coexistence, since the Preboreal, of Beuronian and Sauveterrian groups. Furthermore the frequentation of Choisey "Aux Champins", another open-air site located mid-way between the two, was attributed to the local Early Mesolithic derived from the Ahrensbourgian (Séara, 2000b). The role of cultural crossroad played by this region since the Lateglacial seems to be confirmed also by other sites, both in the Jura (Mevel et al., 2014) and in the Swiss Alps (Crotti et al., 2016).

As regards the Swiss pre-Alps an important sequence encompassing the Lateglacial and Early Holocene was brought to light under a large boulder at Château-d'Œx "Sciernes-Picats", located at 1180 m. a.s.l. (Crotti and Pignat, 1994; Crotti, 2003, 2009; Crotti and Bullinger, 2013; Crotti et al., 2016). At lower altitudes, in the Upper Rhône valley another rock-shelter with an Early-Mid Mesolithic sequence was identified: Vionnaz "Châble Croix" (Pignat and Plisson, 2000). In the subalpine stage (1400-1750 m a.s.l.) numerous open-air sites were discovered , in particular at Zermatt Alp Hermettji (Curdy et al., 2003) in the area of Alburn and of the Simplon pass (Curdy et al., 2010; Crotti and Bullinger, 2013).

As regards the Italian Western Alps, the only evidence comes from Mount Fallère (Valle d'Aosta) (Mezzena and Perrini, 2002; Raiteri, 2013) and Alpe Veglia (Piemonte) (Gambari et al., 1991; Fontana et al., 2000; Di Maio, 2006). All of the lithic assemblages of this area are characterized by the exploitation of local resources represented by rock crystals (quartz) and radiolarites. The former was, almost, the only flaked raw material in the innermost sites, such as the Italian ones. Besides, these sites attest an intensive use of bipolar percussion, a technique allowing the maximum exploitation of cores (Figure 2.14) (cf. Visentin, 2014).

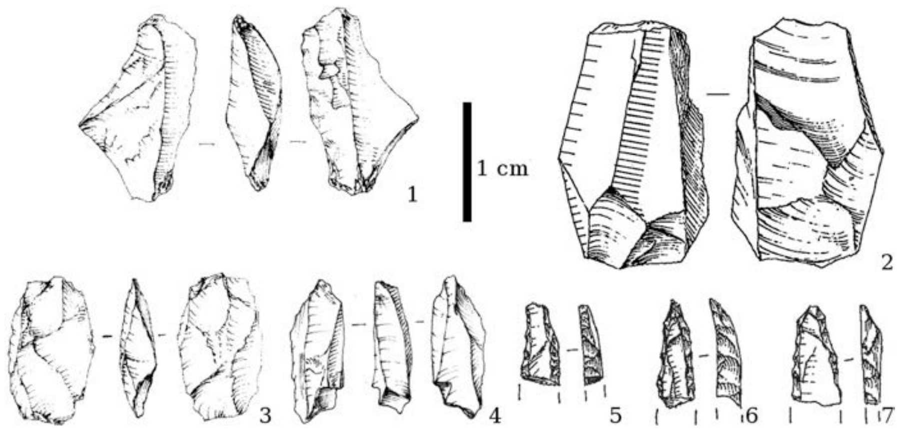

Figure 2.14: Mont Fallère, MF1. Bipolar percussion cores and backed fragments in rock crystall (drawings G. Almerigogna) (after Raiteri, 2013).

North-Eastern Italy and Northern Tuscany

In the central sector of the southern Alps (Lombardian Alps and pre-Alps) the Early Mesolithic evidence is quite scarce as well, although richer than that of the western sector. Among known sites are Pian dei Cavalli (Fedele, 1990; Fedele and Wick, 1996), Dosso Gavia (Angelucci et al., 1994), Val Maione (Biagi and Starnini, 2016), Vaiale and Rondeneto (Biagi, 1994, 1997; Biagi et al., 1994), Cemmo (Martini et al., 2016c) and Cividate Camuno - Via Palazzo (Martini et al., 2016a) (Figure 2.15).

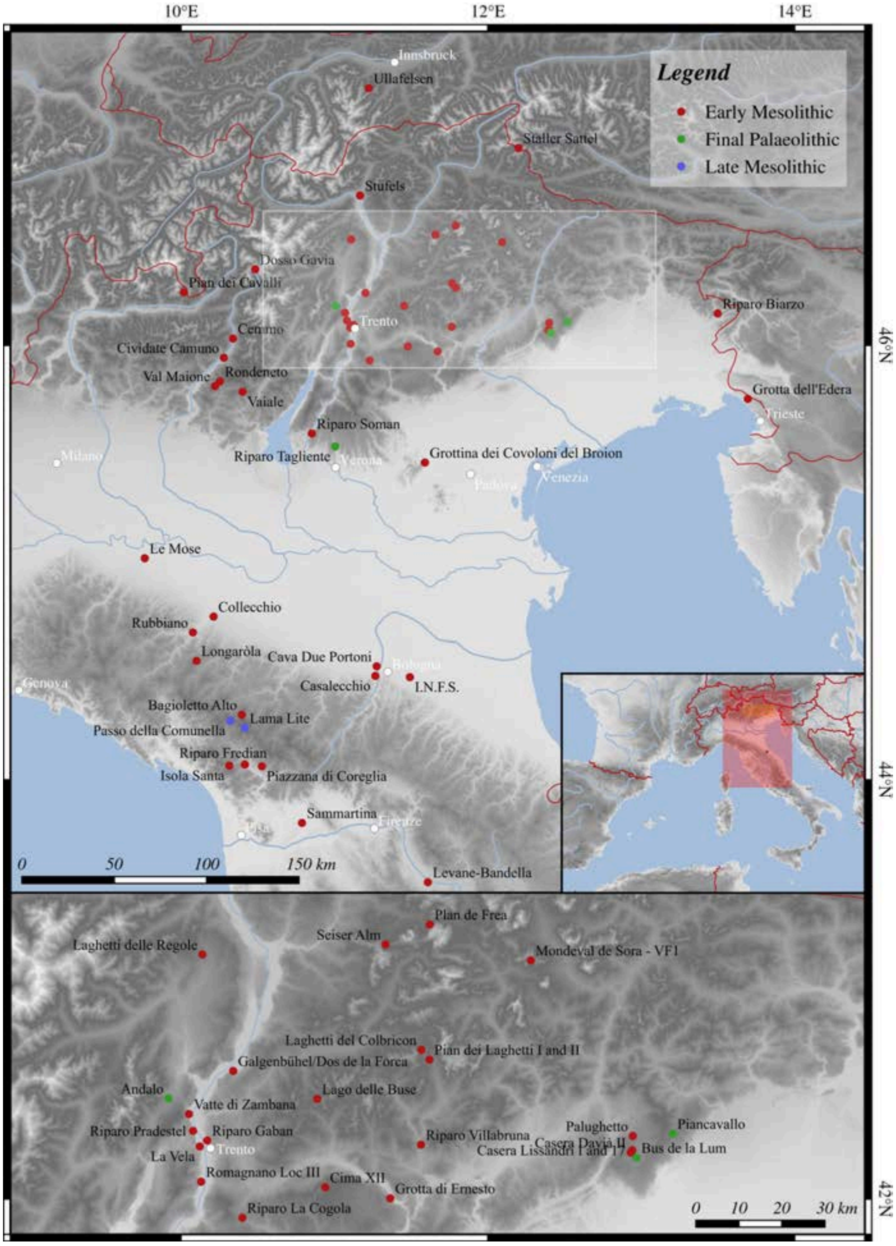

Figure 2.15: North-eastern and central Italy. Location of the mentioned sites.

The Alpine sector comprised between the Adige (Trentino-Alto Adige) and Piave (Veneto) valleys, on the other hand, is the one that yielded the richest evidence in Italy (Bagolini et al., 1983; Bassetti et al., 2009; Broglio, 1976, 1980, 1994; Broglio and Lanzinger, 1990; Dalmeri and Pedrotti, 1994; Fontana, 2011; Fontana and Visentin, 2016; Visentin et al., 2016d,c). In this area and in the easternmost Alps (Friuli-Venezia Giulia), several dozens sites and find-spots were identified in the last 50 years. Some of them, mostly corresponding to rock-sheltered sites, are located along the main valley bottoms. In particular Riparo Soman (Broglio and Lanzinger, 1986; Battaglia et al., 1994), Romagnano Loc III (Broglio, 1976; Broglio and Kozlowski, 1984; Flor et al., 2011; Fontana et al., 2016a), Riparo Pradestel (Bagolini and Broglio, 1975; Dalmeri et al., 2008; Cristiani, 2009), Vatte di Zambana (Broglio, 1976, 1980), Riparo Gaban (Cristiani et al., 2009; Thun Hohenstein et al., 2016a; Kozlowski and Dalmeri, 2002; Perrin, 2006), Galgenbühel/Dos de la Forca (Wierer, 2007, 2008; Wierer and Bertola, 2016; Wierer et al., 2016; Wierer and Boscato, 2006; Bertola et al., 2004; Arrighi et al., 2016; Gala et al., 2016b) and Stufels (Lunz, 1986) are located in the Adige/Isarco valley, Riparo Villabruna (Aimar et al., 1994) in the Piave valley and Riparo Biarzo (Bressan and Guerreschi, 1984; Guerreschi, 1996; Bertolini et al., 2016; Cristiani, 2012; Vai et al., 2015) in the Natisone one. These sites are characterized by thick stratigraphic sequences representing important references for the regional Mesolithic and attesting multiple occupation phases, including both the entire Mesolithic and the Neolithic (Romagnano, Vatte, Pradestel, Gaban) or the Pleistocene-Holocene transition (Soman, Villabruna and Biarzo). At Galgenbühel, on the other hand, the archaeological levels are referred entirely to the Early Mesolithic settlement. These sites, in particular, attest the exploitation of a large spectrum of animal resources, from large mammal forest species (red deer) to alpine ones (ibex) and from small mammals, to fish, molluscs and beavers. Along the pre-Alpine belt sites are mostly located at mid-altitudes (around 1000 m a.s.l.) and in great part represented by open-air locations. Among them the sites of Cima XII in the Asiago plateau, that represent an exception being located at around 2000 m (Frigo and Martello, 1994; Broglio et al., 2006), Palughetto, Casera Lissandri I, Casera Lissandri 17 and Casera Davià II in the Cansiglio plateau (Peresani, 2009; Peresani and Angelini, 2002; Peresani and Bertola, 2010; Peresani et al., 2000, 2009, 2007, 2011; Visentin et al., 2016b). The only sheltered sites are Riparo La Cogola (Dalmeri, 2005; Cusinato et al., 2005; Bertola and Cusinato, 2005; Bazzanella, 2004; Fiore and Tagliacozzo, 2004), in the Folgaria plateau (1070 m a.s.l.) and Grotta d'Ernesto, a small hunting stand located inside a cave (Awsiuk et al., 1994). At a general level all these sites, seem to be functionally oriented towards hunting activities as indicated by the composition of the assemblages (dominated by armatures) and by available functional analyses (Casera Lissandri 17) (Peresani et al., 2009; Visentin et al., 2016b). In the inner part of the Alps, sites are generally located at higher altitudes, mostly between 1800 and 2350 m a.s.l. (Dalmeri and Pedrotti, 1994; Fontana, 2011). The only exception are represented by Le Regole, located at mid altitudes on a lakeshore (Dalmeri et al., 2005a) and Pian dei Laghetti (1488 m a.s.l.) (Bagolini et al., 1984). Most highland sites are represented by surface lithic scatters. Some of them are particularly rich and include up to 300-400 lithic artefacts (Cesco Frare and Mondini, 2005; Lunz, 1986; Dalmeri and Pedrotti, 1994; Visentin et al., 2016d,c). A few among them have been the object of stratigraphic excavations: Laghetti del Colbricon with its nine sites (Bagolini, 1972; Bagolini and Dalmeri, 1987; Grimaldi, 2006), Seiser Alm XV and XVI (Lanzinger, 1985), Lago delle Buse 1 and 2 (Dalmeri and Lanzinger, 1994; Lemorini, 1994), Plan de Frea I - IV (Broglio et al., 1983; Alessio et al., 1996; Angelucci et al., 2001, 1999), Staller Sattel STS 4a (Kompatscher et al., 2016) and Mondeval de Sora VF1, sectors

I and III (Alciati et al., 1994; Fontana and Vullo, 2000; Fontana et al., 2009c,d; Berto et al., 2016; Colombo et al., 2016; Valletta et al., 2016; Thun Hohenstein et al., 2016b). In most cases, available data indicate that these highland settlements were specialized sites dedicated to the procurement and processing of animal resources. In particular the analysis of the faunal assemblages of Plan de Frea IV and Mondeval de Sora VF1 indicate that red deers and ibexes were the most hunted species. This is confirmed also by the high percentage of impact fractures detected on microlithic armatures (Fontana et al., 2009c). Nonetheless the presence of important dwelling structures at these two sites indicates a possible additional residential role. At Mondeval de Sora VF1, moreover, functional analyses suggest a relatively high incidence of woodworking in the spectrum of carried out activities.

In the Northern Alps (Tyrol, Austria), it should be mentioned the site of Ullafelsen (Schäfer, 2011; Schäfer et al., 2016). The excavation of the site allowed identifying two main settlement phases, the first one dated to the Early Preboreal is associated to Sauveterrian (South Alpine) groups and the second, of Boreal age, to Beuronian ones. Among the peculiarities of the site, Preboreal hearths document the transformation of birch bark into organic tar through an oxygen-reduced burning process. Numerous cave sites are located also in the Trieste Karst area. They have been the object of early excavation and, at least as regards the Sauveterrian, very few data are available (cf. Biagi et al., 2008).

As regards the Venetian-Friulian plain, Mesolithic evidence is quite rich. In particular, all along the springs line and towards the Venetian lagoon numerous sites were identified (Corazza et al., 2009; Fontana et al., 2016b; Fontana and Visentin, 2016). All of these sites, unfortunately, are surface lithic scatters collected in laboured fields. The only excavated context is represented by the Grottina dei Covoloni del Broion, in the Berici hills (Ligabue, 1973, 1974, 1975, 1977; Cattani, 1977).

The situation in the southern Po plain is completely different. Here five open air sites were extensively excavated. Three of them are located in the surroundings of Bologna, I.N.F.S. (Farabegoli et al., 1994), Casalecchio (Fontana and Cremona, 2008) and Cava Due Portoni (Cremaschi et al., 1990), one near Parma, Collecchio (Visentin et al., 2014, 2016a), and the last one near Piacenza, Le Mose (Marchesini et al., 2016; Fontana and Cremona, 2008). Lithic raw materials were mostly collected at a local scale and the lack of evidence of exchanges with the northern part of the plain suggests the presence of distinct territories north and south of the river Po (Fontana and Visentin, 2016). On the basis of the available record, both Casalecchio and INFS (Figure 2.16) can be considered as short-term hunting camps while archaeological evidence from Cava due Portoni seems to indicate longer periods of stay, although in contrast with its armature-dominated lithic assemblage (Fontana and Cremona, 2008; Fontana et al., 2009a,b, 2013; Fontana and Visentin, 2016; Visentin and Fontana, 2016). Evidence from Collecchio reflects a dominance of domestic over hunting activities while the different loci of Le Mose indicate a high variety of situations. As regards lithic assemblages, the Preboreal sites of these area (Collecchio and INFS) are characterized by the almost complete absence of triangular microliths.

On the hilly terraced surfaces bordering the main Apennine valleys (150-700 m a.s.l.) only a few sites were identified (Fontana et al., 2013). Two of them were the object of stratigraphic excavations: Rubbiano, located at the confluence of the Taro and Ceno rivers, and Longaròla, on the northern slope of Mount Montagnana (De Marchi, 2003).

On the mid- and highlands (1100-1800 m a.s.l.) the richest evidence of the region in terms of site number was identified, mostly in correspondence of dominating locations

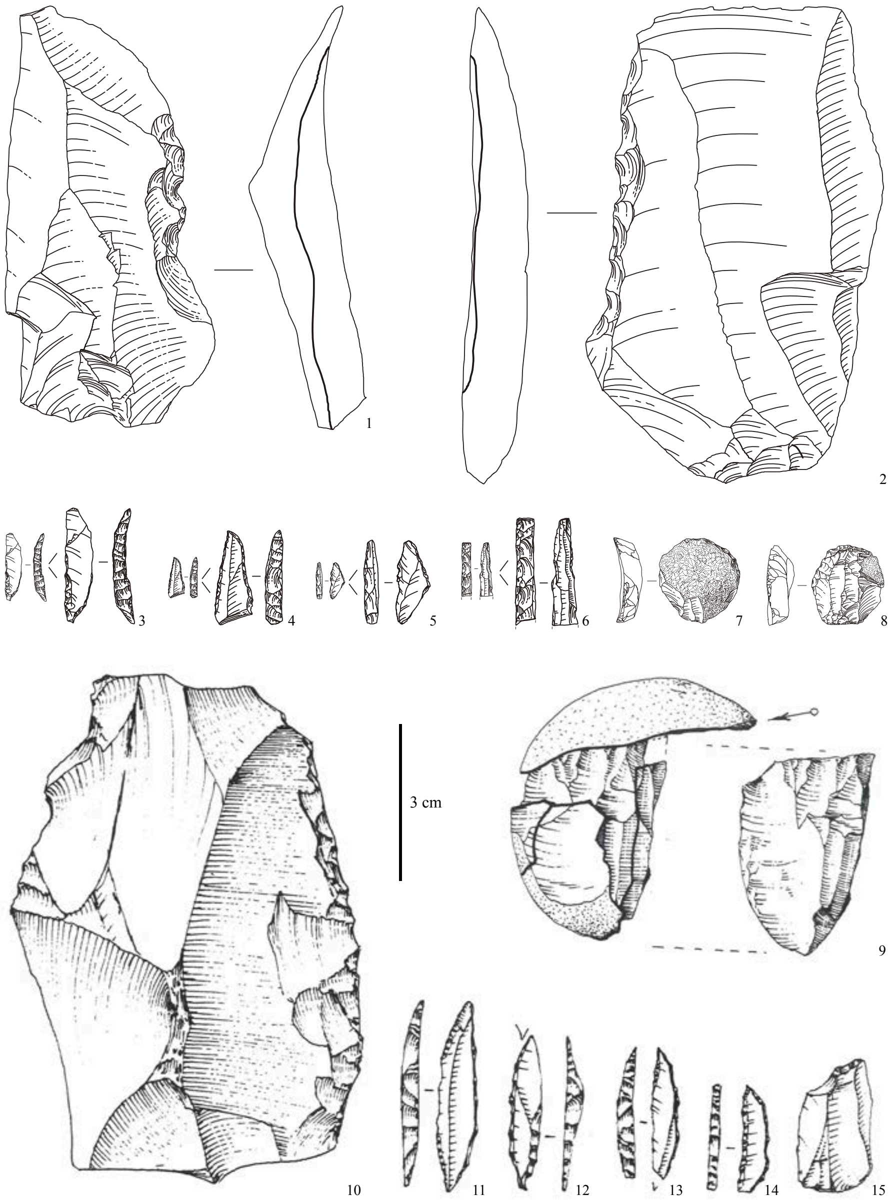

Figure 2.16: Casalecchio (1-8) and INFS (9-15), lithic industry. 1) denticulated piece; 2) retouched piece; 3) crescent; 4-5) triangles; 6) backed fragment; 7-8. endscrapers; 9) refitting assemblage showing the exploitation of a chert pebble; 10) scraper (silicified siltstone); 11-13) backed points; 14) crescent; 15) truncation (Drawings D. Mengoli and G. Almerigogna) (after Visentin and Fontana, 2016).

or near small lakes and passes (Biagi et al., 1980; Ghiretti and Guerreschi, 1990; Fontana et al., 2013). The richest evidence comes from Bagioletto Alto, situated at 1725 m a.s.l. in the Apennines of Reggio Emilia (Cremaschi et al., 1984), which was dated to the mid-Boreal. The lithic assemblage was obtained mostly from local cherts coming both from the Emilian and Tuscan Apennine slopes but also from cherty marine pebbles of the Apennine margin and displays the most typical Sauveterrian features. The site was interpreted as a seasonal residential camp.

Furthermore in the Tuscan side of the northern Apennines Isola Santa (Kozlowski et al., 2003), Piazzana di Coreglia (Biagi et al., 1980; Radmilli, 1982), Riparo Fredian (Boschian et al., 1995), Sammartina (Gheser and Martini, 1985) and Levane-Bandella (Magi et al., 2008) are found.

Central and Southern Italy

As regards the Early Mesolithic of Central and Southern Italy, lithic industries apparently reflect a complex and inhomogeneous cultural landscape (Martini and Tozzi, 1996; Lo Vetro and Martini, 2016). Such diversification is supposed to have originated from the cultural variability that characterized the Italian peninsula and the islands since the Late Epigravettian, also influenced by its complex mosaic of landscapes. Therefore four different cultural *facies* were recognized: the Sauveterrian-like *facies*, the Undifferentiated Epipalaeolithic, the Epiromanellian and the Epigravettian-tradition *facies*. Moreover the differences identified between the Sauveterrian-like complexes of Central and Southern Italy and those of the Northern part of the country are interpreted as the result of regional adaptations of the Sauveterian technology, that progressively diffused southwards from its northern cradle.

In central Italy, (almost) all the sites are attributable to the Sauveterrian-like *facies* (Figure 2.17). Among them are Grotta Continenza (Bevilacqua, 1994; Angeli et al., 2011a; Grifoni Cremonesi et al., 2011), Grotta di Pozzo (D'Angelo, 2004; Mussi et al., 2011) and Ortucchio (Angeli et al., 2011b,a) in the Fucino basin (Abruzzo). For these sites, the production of bladelets, laminar flakes and flakes is reported. Cores are mostly exploited with frontal or centripetal methods (these latter being dedicated to the production of flakes). Typologically these assemblages are similar to North Italian ones (Figure 2.18). Further South (Figure 2.17) the Sauveterrian-like *facies* is found also at Grotta della Cala (Moroni et al., 2016), Grotta della Serratura (Martini, 1993) and Riparo del Romito (Martini et al., 2016b) along the Tyrrhenian coast; Grotta delle Mura (Calattini, 1986; Calattini and Tessaro, 2016) and Grotta Marisa (Astuti et al., 2005) (Figure 2.19) in Apulia, along the Adriatic coast, as well as at Perriere Sottano (Aranguren and Revedin, 1998), Grotta d'Oriente (Martini et al., 2012b) and at the Isolidda sites (Lo Vetro et al., 2016) in Sicily. The Sicilian assemblages are also reported to include innovative elements, among which "short and wide double- backed points with convex edges, and lozenge- and rhomboid- shaped backed points" (Lo Vetro and Martini, 2016, p. 295) (Figure 2.20).

The Undifferentiated Epipalaeolithic (Martini, 1993, 2005) includes several lithic industries "sharing a low technical investment in flaking and tool production, and a typological structure marked by a high amount of common tools (mainly consisting of scrapers, notches and denticulates)" (Lo Vetro and Martini, 2016, p. 290) while microliths are either rare or absent (e.g. in Sardinia). The Undifferentiated Epipalaeolithic, although being quite widespread in Southern Italy, presents a patchy distribution, including mostly (but not only) coastal areas and being interposed between the different cultural groups of the region. The main sites are represented by Riparo

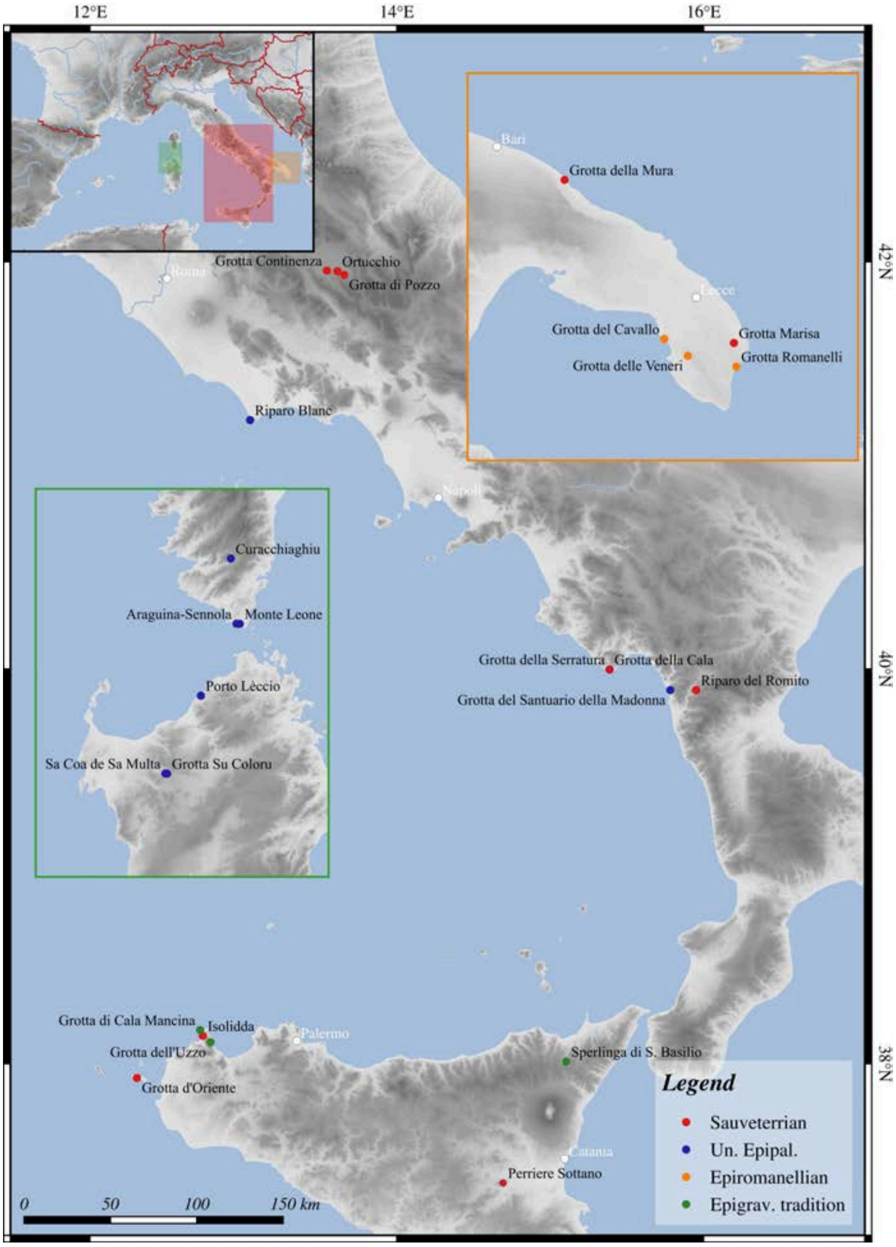

Figure 2.17: Central-southern Italy and islands. Location of the mentioned sites.

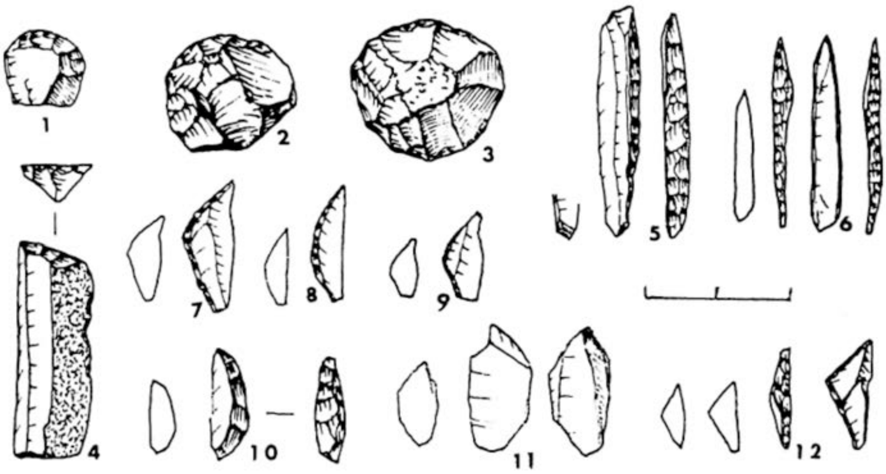

Figure 2.18: Riparo Fredian, layer 4. 1-3) end-scrapers; 4) truncation; 5) backed bladelet; 6) backed point; 7-9, 12) triangles; 10) crescent; 11) microburin (after Boschian et al., 1995).

Blanc (Taschini, 1964, 1968), Grotta della Serratura (Martini, 1993) and Grotta del Santuario della Madonna a Praia a Mare (Tagliacozzo et al., 2016; Fiore et al., 2016; Gala et al., 2016a) along the Tyrrhenian coast; Perriere Sottano (Aranguren and Revedin, 1998) in Sicily; Grotta Su Coloru, Porto Leccio and Sa Coa de Sa Multa in Sardinia (Martini, 1999). According to some authors (Martini and Tozzi, 2012) Undifferentiated Epipalaeolithic sites are attested also in Corsica, at Curacchiagghiu, Araguina-Sennola and Monte Leone. Lithic reduction schemes were aimed at obtaining wide flakes by direct percussion. Exploitation was mainly unidirectional, although multiple opportunistic reorientations of the cores are also attested (cf. Valdeyron, 2008b).

Two minor complexes are reported in the Salento peninsula (Apulia) and in Sicily. The former one was named Epiromanellian by Palma di Cesnola (Palma di Cesnola et al., 1985). This *facies* is characterized, at a typological level, by a high percentage of circular and sub-circular microlithic end-scrapers (up to 15 mm) along with truncations, borers and backed tools, while geometrics and other tool-types such as scrapers and denticulates are less represented (Lo Vetro and Martini, 2016). The main sites attributed to the Epiromanellian are Grotta Romanelli (Fabbri et al., 2003), Grotta del Cavallo and Grotta delle Veneri.

In Sicily, some lithic assemblages characterized by microliths and very small common tools are attested and dated between around 11,000 and 8,100 cal BP (Lo Vetro and Martini, 2016). These have been interpreted as a local aspect and named "Epigravettian-tradition microlithic facies". The sites that yielded such assemblages are Grotta di Cala Mancina (Martini et al., 2012a), Riparo della Sperlinga di San Basilio (Biddittu, 1971) and Grotta dell'Uzzo (Lo Vetro and Martini, 2012). At Cala Mancina, the intensive unidirectional exploitation of small blocks and pebbles is attested. Blanks, mainly bladelets, were transformed into convex backed points, rare large backed tools and different triangles, trapezes, and crescents.

The analysis of faunal remains from the above presented sites indicates that a wide range of species was hunted. In most cases medium/large mammals (red deer and wild boar, but also ibex in mountain sites such as Riparo Fredian) are predominant.

In the Apulian plain also equids (*Equus caballus* and *Equus hydruntinus*) and aurochs (*Bos primigenius* and *Bos* sp.) are attested. In addition other animal resources, both terrestrial and aquatic, such as lagomorphs, small carnivores, birds, amphibians and land snails were procured. In coastal sites marine resources (fish and shellfish), clearly, played an important role although isotopic evidence indicates that the diet was always based on terrestrial resources (Mannino et al., 2012).

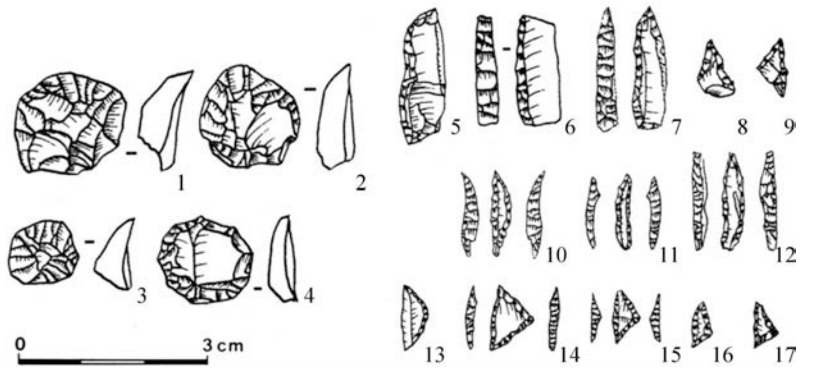

Figure 2.19: Grotta Marisa, levels 5-1. 1-4) end-scrapers; 5) backed-and-truncated bladelet; 6) backed bladelet; 7) backed point; 8-9) triangular double backed points; 10-12) double backed points; 13) crescent; 14-17) triangles (after Astuti et al., 2005).

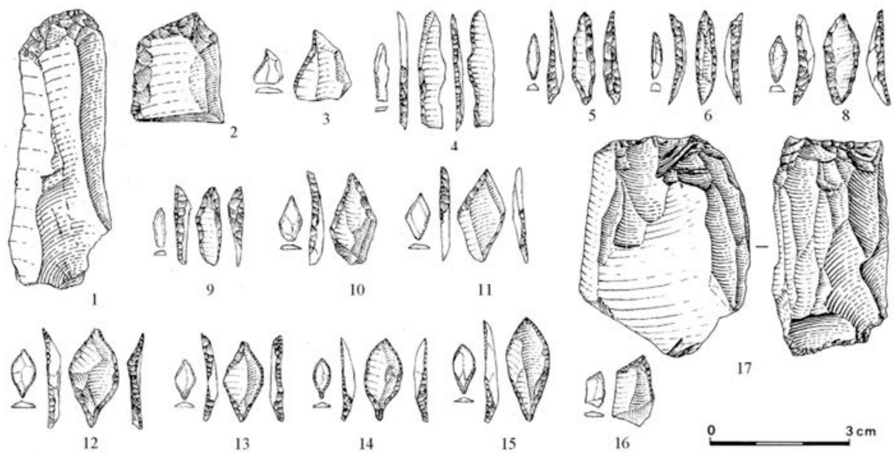

Figure 2.20: Perriere Sottano, Sauveterrian level. 1,2) end-scrapers; 3-4) backed points; 5-15) double-backed points; 16) backed-and-truncated bladelet; 17) core (after Aranguren and Revedin 1998 in Lo Vetro and Martini 2016).

2.3.2 Neighbouring cultural groups

The Early Mesolithic of central Europe is characterized by the development of the Beuronian complex. In Southern Germany, where it was at first defined, it is preceded by a Late Palaeolithic phase (Allerød-Younger Dryas) characterized by backed points and backed bladelets together with short scrapers, circular scrapers and burins (Jochim, 2008). On the basis of a typological classification, Wolfgang Taute (1974) divided the Mesolithic assemblages of Southern Germany into two main phases: an Early Mesolithic or Beuronian, characterized by the abundance of microlithic points and triangles, and a Late Mesolithic, in which trapezes and regular blades produced by punch or pressure technique as well as broad antler harpoons are attested. According to Taute and on the base of stratigraphic and radiometric data, the Beuronian could be divided into three stages (Figure 2.21):

- Beuronian A characterized by obtuse-angled isosceles triangles, narrow trapezes on irregular blades and lanceolate points with convex, bifacially retouched bases;
- Beuronian B characterized by acute-angled isosceles triangles and lanceolate points with concave, bifacially retouched bases;
- Beuronian C characterized by small and narrow scalene triangles, backed bladelets, small double backed points and lanceolate points with concave directly retouched bases.

Recent studies demonstrated the limits of this strictly typological subdivision and most authors prefer to divide the Beuronian in only 2 stages (Jochim, 2006, 2008; Kind, 2006, 2009); the first one, corresponding to the Beuronian A and B, is characterized by large isosceles triangles together with lanceolate points with dorso-ventrally retouched bases, while in the following one small scalene triangles and lanceolate points with directly retouched bases are dominant. In addition some authors define as "Earliest Mesolithic" the very first phase in which only obliquely retouched points are attested (Jochim, 2008). A characteristic feature of the Early Mesolithic of South-Western Germany is the intentional heating of lithic raw materials. Such a technique, that is supposed to be aimed at the improving of knapping suitability, was not applied in the previous and later periods (Eriksen, 2006). Curiously this technique stops to be used when the punch/pressure flaking begins.

In northern Germany, north-eastern France and southern Belgium the Early Beuronian assemblages are dominated by crescents, associated to some points and scalene triangles. Because of these differences Gob (1981) defined a Beuronian northern and southern *facies*. The current situation is not as linear as that of Southern Germany and different terminologies and classification are in use. For example in Belgium, the numerous excavation of Mesolithic sites carried out since the 1980ies brought to the formation of different local groups (cf. Crombé et al., 2008; Vermeersch, 2008). In north-eastern France (up to the Paris basin and the Cher valley), Early Mesolithic assemblages are generally attributed to the so-called "Beuronian with crescents" (Ducrocq, 2013). One of the main differences with respect to the "classic" Beuronian is that triangles are replaced by crescents (Figure 2.22).

Between this large complex and the Sauveterrian, different small cultural groups have been identified. Among them is the Bertheaume group in Finistère, characterized by hyper-microlithic isosceles triangles and Bertheaume bladelets (Blanchet et al., 2006; Marchand, 2008; Michel, 2011). In central-western France the *Mésolithique ancien ligérien* and the *Mésolithique ancien charentais* were defined, the former characterized, among other tool types, by naturally backed points and the latter by backed points with retouched bases, triangles and backed bladelets (Michel, 2007, 2009, 2011). In Seine-et-Marne, during the Boreal, the *Sauveterrien à denticulés* developed (Hinout, 1990, 1992). The marker of this group is represented by Chateaubriand points (similar to large Sauveterre-like backed points).

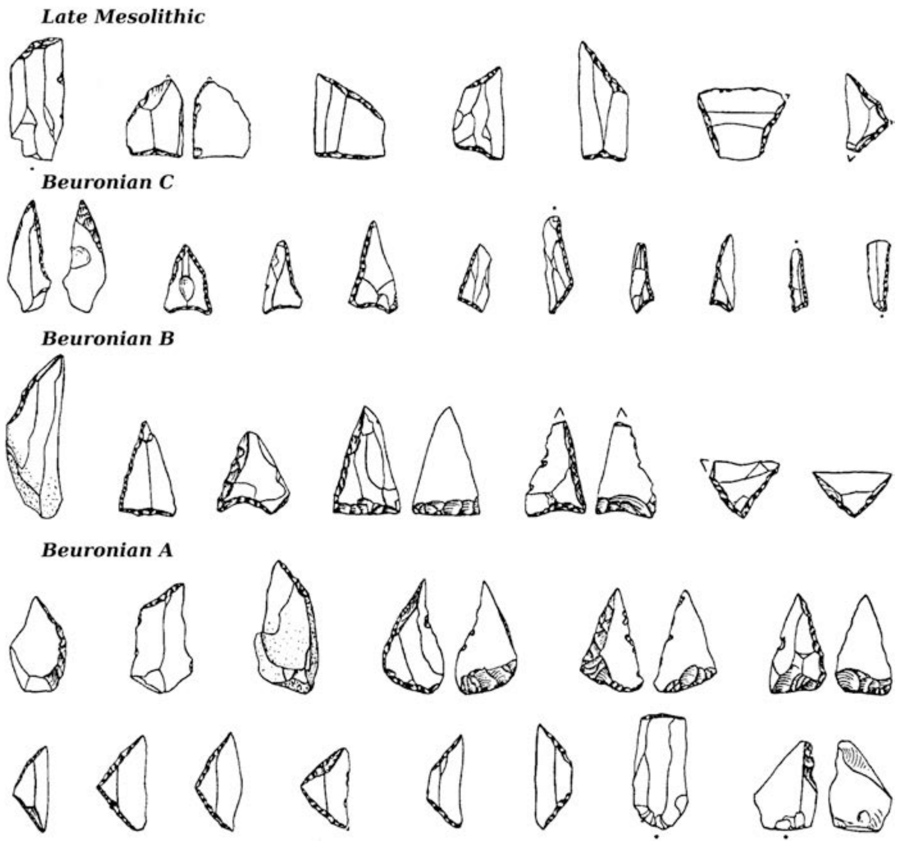

Figure 2.21: Typological subdivision of the Mesolithic in south-western Germany according to Taute (1974) (after Kind, 2006)

South of the Pyrenees, in particular in the Ebro basin and along the Mediterranean coast, the cultural sequence that was highlighted attests trends similar to the French and Italian ones, at least up to the end of the Preboreal period, although the lack of a uniformed nomenclature complicates the perception of this phenomenon. The lithic assemblages of the final Pleistocene, that are called either *Epimagdaleniense reciente*, *Aziliense* or *Magdaleniense final* according to different authors (cf. Roman, 2010), are characterized by (curved) backed points and bladelets, triangles, crescents and the appearance of the microburin technique (Roman, 2015). In the Ebro valley also the progressive shortening of end-scrapers is attested (Soto Sebastián et al., 2015) These assemblages present a strong continuity both with the previous Magdalenian complexes and the following Preboreal ones and a slow evolutionary process can be identified. The earliest Holocene assemblages are most commonly called *Sauveterroide microlaminar*. In these assemblages, although the percentage of geometric microliths increases, backed points and bladelets are still dominant. Between around 10,200 and 8200 cal BP a drastic change is marked by the appearance, over a large territory, of the *muescas y denticulatos* industries (Soto Sebastián, 2014). These are characterized by reduction schemes oriented to the production of flakes using strictly local raw materials. Armatures are completely missing and retouched tools are mostly represented by notched and denticulated pieces. This phase is followed by the *geométrica* one, that

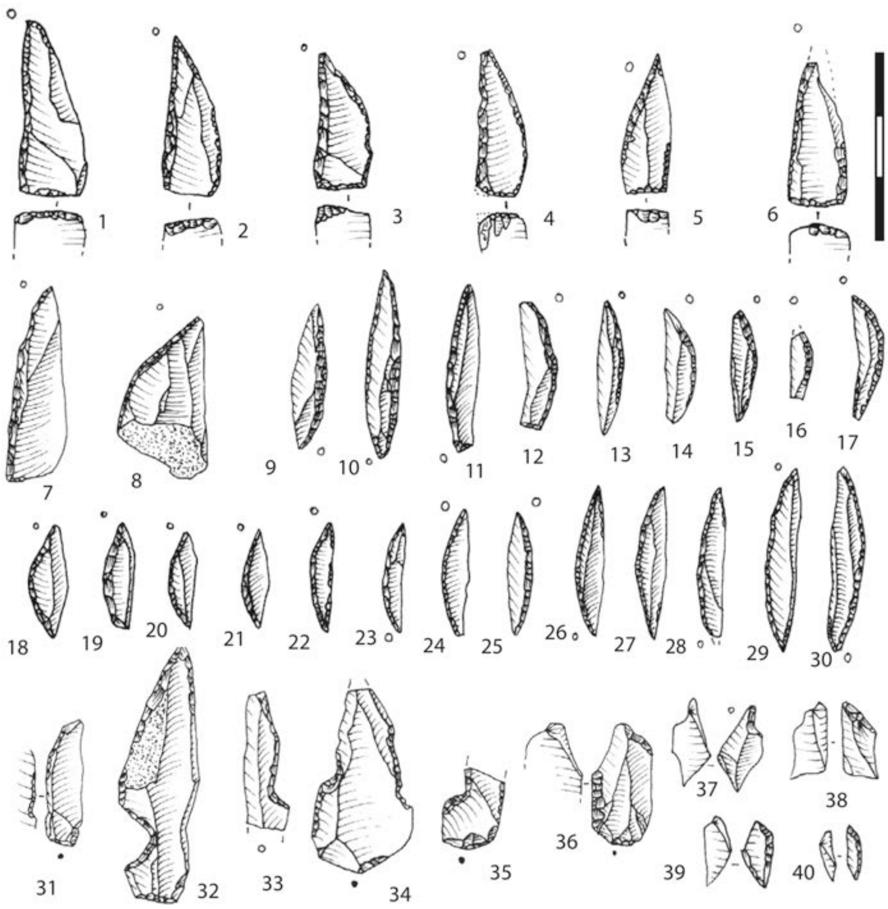

Figure 2.22: Warluis I, "Beuronian with crescents". 1-6) points with retouched base ; 7-8) natural based points; 9-30) crescents; 31-35) incomplete pieces; 36-40) microburins (drawings by T. Ducrocq) (after Ducrocq, 2013).

sees the reappearance of geometric microliths and the laminar production, and can be associated to the Late Mesolithic (Soto Sebastián, 2014; Perales Barrón, 2015).

2.4 Chronological background

The definition of the Mesolithic from a chronological point of view is a much debated topic. While its upper term corresponds the appearance of the Neolithic, a phenomenon that in Europe is characterized by a chronological gradient (southeast to northwest), the lower (Palaeolithic-Mesolithic) and mid (Early-Late Mesolithic) limits are controversial. As regards the lower one, this is particularly due to the fact that there is not an unanimous consensus on the criteria that differentiate the Palaeolithic from the Mesolithic. This applies not only at a European level but also at a regional scale. As regards north-eastern Italy and because of the above mentioned techno-typological continuity, authors mostly follow the proposition by P. Mellars (1981) to draw the line at the boundary between Pleistocene and Holocene that is 10,000 BP (11,550 cal BP). Although this proposition was based on north European contexts (particularly Britain, Scandinavia and the north European plains) where it actually corresponds to a behavioural change dictated by the passage from open tundra-like environment to fully forested conditions (while in the southern Alps such a change can be dated to the Bølling/Allerød interstadial), it seemed the only way to part the two assemblages. Other authors, on the other hand, do not follow strictly this criterion. For example, although being dated to the Preboreal, a Late Epigravettian attribution was proposed for level 18 of Riparo La Cogola because of its higher affinity to the lower Epigravettian layer 19 than to the Sauveterrian one (L. 16) (Cusinato et al., 2005). As regards Southern France, the techno-typological criterion is generally accepted. This viewpoint has been recently enforced by the development of the studies on the Laborian complex that according to the recentmost datings includes the last part of the Younger Dryas and the first centuries of the Preboreal. Nonetheless, the fact that Sauveterrian and Epilaborian datings overlap reflects the difficulties in identifying clear chronological boundaries between the two.

As regards the transition between Early and Late Mesolithic, the problem lies in identifying the modalities in which this transition took place (exclusively technological acculturation vs. people migration). For more detailed discussions on this topic refer to (Fontana et al., 2016a; Franco, 2011; Marchand, 2014; Perrin and Defranould, 2016; Perrin et al., 2009; Philibert, 2016; Marchand and Perrin, 2017). In south-eastern France the presence of assemblages including both trapezes along with triangular microliths allowed to propose the existence of a transitional phase that was attributed to the last Sauveterrian/Montclusian groups (“*Montclusien à trapezes*”; cf. Escalon De Fonton, 1966). Most recently, by reanalyzing the transitional levels of Montclus it was proposed that the association of trapezoidal and triangular microliths is exclusively the result of a stratigraphic mixing (Perrin and Defranould, 2016). On the other hand in northern Italy, the association of these two types of armatures was interpreted as the first phase of the Castelnovian complex, marked by the presence of symmetric trapezes, pressure/indirect percussion knapping technique and the persistence of Sauveterrian microliths (Broglio, 1980). At a general level, the problem of the stratigraphic reliability cannot be easily discarded. Most of the sites that yielded stratigraphic sequences encompassing the Early/Late Mesolithic transition are, in fact, represented by old excavations in which the extent of taphonomic phenomena is not easily assessable. At the same time the fact that in all Italian open air Castelnovian sites a few triangular microliths are attested is troubling to say the least (Fontana et al., 2016a).

Although being impossible to solve all of these issues in the framework of this thesis, it was necessary to chronologically delimit the Sauveterrian in Southern France and Northern Italy. With this aim, and for identifying eventual internal diachronic trends, all the radiocarbon datings referable to the Early Mesolithic assemblages of the area were collected (Appendix A). These were grouped into four main regions: south-western France (between the Pyrenees and the Massif Central); south-eastern France (including the lower Rhône basin, Provence and the French pre-alpine massifs); north-eastern Italy (including the central and eastern Alps and pre-Alps); the northern Apennines (including also the Emilian plain sites). Totally 223 radiocarbon datings were collected. Among them were included also those referred to levels that were attributed to the Late Palaeolithic although being of Preboreal age and to the earliest Late Mesolithic evidence. Raw data were then sorted by radiocarbon age and plotted in OxCal v4.2.4 (Bronk Ramsey, 2009) using IntCal13 atmospheric curve (Reimer et al., 2013). Eventual multiple ranges were merged. This allowed to identify for the four investigated regions, the chronological ranges in which Late Palaeolithic, Early Mesolithic and Late Mesolithic datings overlap. Results were summarized in Figure 2.23, while complete plots are reported by region in Appendix A.

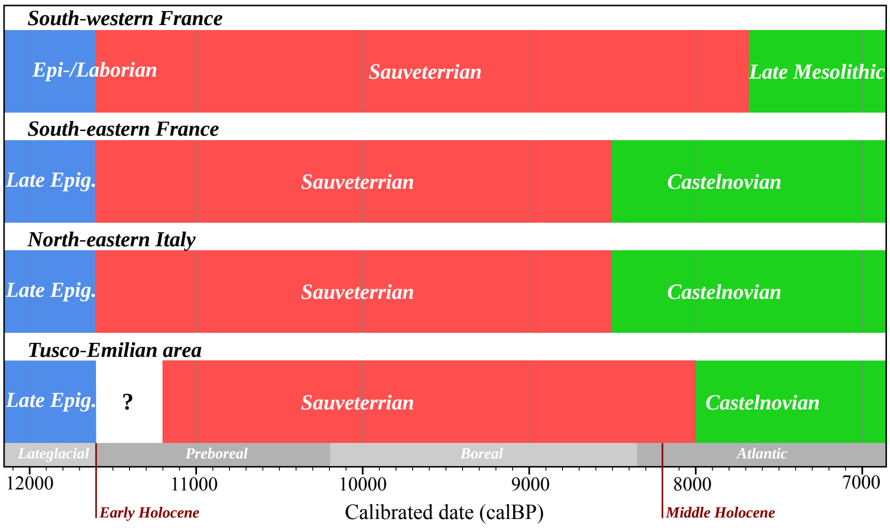

Figure 2.23: Radiocarbon evidence and cultural attribution for the four investigated territories.

In south-western France, currently, the most recent date for the Epilaborian is that of Pont d'Ambon (cf. Langlais et al., 2015) placing the assemblage at 11,249-10,607 cal BP. Considering the datings of Fontfaurès, Abeurador and Balma Margineda , older although with larger standard errors, the Sauveterrian is supposed to have appeared in the first 6 centuries of the Preboreal. If we exclude the datings of level 3 of Rouffignac (the assemblage includes both Sauveterrian and Castelnovian artefacts) and of layer 3c of Buholoup (reported as unreliable)(Briois and Vaquer, 2009) the Sauveterrian seems to be attested, at least, until the end of the Early Holocene (8200 cal BP), much longer than in the other areas. The first Late Mesolithic datings, in fact, are those from Les Escabasses (layer 5, 8152-7835 cal BP)(Valdeyron et al., 2008) and Cuzoul de Gramat (around 7700-7500, HA2 and SG5220)(Valdeyron et al., 2014).

The Earliest Sauveterrian dating in south-eastern France is that of Le Sansonnet placing the settlement at the very beginning of the Holocene (11,937-11,230 cal BP). Nonetheless some assemblages that were attributed to the Late Palaeolithic yielded comparable datings. Among them are those of layer 7a of La Vieille Eglise, although being not very reliable considering the large standard errors, and the two of Abri Martin, whose assemblage was interpreted as a Late Epigravettian one (11,979-11,294 cal BP and 11,240-10,781 cal BP)(Tomasso, 2015). The upper limit of the Sauveterrian in this region is dated to 8800-8500 cal BP. The earliest Castelnovian evidence is that of La Grande Rivoire (d34, 8637-8455 cal BP)(Angelin et al., 2016), although it predates most of the Sauveterrian levels of Montclus. A more reliable dating for the the first Castelnovian is that of Mourre du Sève (8606-8406 cal BP)(Marchand and Perrin, 2017).

In north-eastern Italy the lower limit of the Sauveterrian, as above explained, is the conventional one. Nonetheless layer 18 of La Cogola is dated to 11,391-11,142 cal BP and still presents Epigravettian-like features (Dalmeri, 2005). On the other hand Plan de Frea IV (layer 3B IV) and Romagnano Loc III (layer AF), although being older, are interpreted as Sauveterrian. Placing the upper limit is more complex as there are at least 15 similar Sauveterrian and Castelnovian datings covering the interval between 9000 and 8500 cal BP. Among them are not only multilayer sequences such as the Adige valley ones, but also recently excavated open air sites such as Laghetti del Crestoso (Castelnovian) and Staller Sattel (Sauveterrian). The older datings for the Castelnovian belonging to Riparo Gaban are without any doubts due to stratigraphic problems and referable to the Sauveterrian.

In the Tusco-Emilian area, radiocarbon evidence is much less robust and completely absent for the first 4 centuries of the Preboreal. The oldest evidence is represented by the site of Collecchio, whose settlement is dated between 11,200 and 10,500 cal BP. The most recent dating that can be reliably attributed to the Saveterrian is that of Piazzana (9270-8650 cal BP). The two following ones, belonging to layer 4a of Isola Santa are much younger and almost contemporaneous to the Castelnovian dating of Piazzana (8339-7983 cal BP)(Kozlowski et al., 2003). Moreover, the presence of trapezes in the lithic assemblage suggests that the two of them cannot be considered as reliable, and most likely referable to an ephemeral Castelnovian occupation of the site.

Chapter 3

Methodological framework

Contents

3.1 Theoretical overview

Traditionally, the study and definition of Palaeolithic and Mesolithic cultures has been dominantly based on the analysis of lithic assemblages. During the past two centuries different methodologies were proposed. Initially it was the typological approach, the climax of which was reached during the 1950'ies and 1960'ies with the publication of F. Bordes (1961) and G. Laplace's works (1964a). Parallelly the development of experimental studies (e.g. Bordes, 1947) and functional approaches (Semenov, 1964) started and in the same years the technological method based on the concept of *chaîne opératoire* was founded (Mauss, 1947; Leroi-Gourhan, 1964). At first typology and technology (most commonly applied with respect to functional analysis) were seen as independent approaches aimed at distinct objectives (Valentin, 2008). The former was limited to "tools" and armatures and the latter to debitage wastes. Nowadays this vision is deprecated and the three methodologies are generally seen as complementary. In the most famous handbook of lithic technology it is reported "*We do not therefore consider substituting technology for typology, for they represent two distinct approaches developed to meet different ends; they can however be used concurrently, and great benefit can be derived from the comparison of the results they yield*" (Inizan et al., 1999, p. 13). During the last decades, mostly in connection with the exploratory and formative phases of these as well as other disciplines, researchers were prone to identify and recognize themselves as either typologists, technologists, traceologists, etc. Nowadays, researchers applying both the typological and technological methods are numerous while only rarely techno-typological and functional analyses are carried out by the same person. This development is actually quite far from Semenov's vision that, as testified by the title of his most famous work "Prehistoric Technology" (1964), considered technology as a global concept, encompassing all the traces attested on the lithic artefacts, from those reflecting production stages to the ones produced during their utilization (cf. Gueret, 2013b). Such a perspective is also fundamentally linked to the concept of *chaîne opératoire* that is at the base of the French palaeoethnological approach founded by A. Leroi-Gourhan. In the study of lithic assemblages, in fact, "*the* chaîne opératoire *encompasses all the successive processes, from the procurement of raw material until it is discarded, passing through all the stages of manufacture and use of the different components. The concept of* chaîne opératoire *makes it possible to structure man's use of materials by placing each artefact in a technical context, and offers a methodological framework for each level of interpretation*" (Inizan et al., 1999, p. 14). In spite of this theoretical definition, the term technology has been mostly reserved to the study of lithic raw material transformation processes and not to the interaction of lithic artefacts with other materials that, to say the least, is as technological as the former one. Most lately, a good number of works, in great part carried out by "traceologists", is going in this perspective and the distinction between the two approaches is getting narrower (e.g. Claud, 2008; Van Gijn, 2010; Gueret, 2013b; Chesnaux, 2014a).

Another interesting line of thoughts concerning the history and development of lithic artefact analysis regards the interpretative level and the methodological issues connected to it. During the first half of the 20th century - particularly but not only - the attempt to create typological evolutionary sequences marked by the appearance and disappearance of particular tool morphotypes (guide fossils) brought the so called material culture to be not only the means but also the aim of archaeological research (Briz et al., 2005). In line with cultural historical theories, lithic artefacts were considered to be defining elements of prehistoric cultures and, as such, differences and similarities in their morphology and percentage became valid parameters for the creation of groups and subgroups more or less directly related to social, chronological and ethnic entities. Ethnology was used to validate these assumption, although "*from an ethnological point of view, [...] a human group is never defined or characterised by the technological development that it achieves, let alone by the sum of the morphologies of its tools. What defines the identity of a human group is its specific social organisation for production and reproduction, which is the result of its historic development*" (Briz et al., 2005, p. 2). This was one of the most severe criticisms of processual archaeology with respect to previous theories but, a few decades later, it is still a relevant and sometimes forgotten notion.

In light of these premises, the methodology applied to the present work follows up on Semenov's general perspective and can be defined as a technological approach in its broader sense, that is the study of transformation processes and past technical knowledge. Flaked lithic assemblages, being the main object of research, are regarded as a proxy for investigating socio-economic phenomena of past societies. It goes without saying that the application of this methodology to a single class of objects - lithic flaked artefacts - can only result in a partial understanding of past technical processes. "*Yet, microwear research offers an excellent method for studying multiple* chaînes opératoires *and examining the technological choices made through time and space*"(Van Gijn, 2014, p. 168). With the aim of comparing the Early Mesolithic assemblages of north-eastern Italy and southern France, technological analysis mostly pursued the identification and definition of the objectives of the lithic production by combining the reconstruction of the technical systems devoted to the transformation of raw materials into tools (*sensu lato*) and of the needs motivating their production. Starting from this general objective the reduction sequences of tool production and use were retraced, step by step, up to the strategies of procurement of raw materials. In this perspective the comparison of the technical procedures and solutions carried out in different sites and at different times is supposed to allow the identification of shared (or not) technical know-hows, thus, providing additional data, with respect to the traditional "stylistic" ones, for the comparison of Sauveterrian lithic assemblages.

3.2 Methodology in practice

3.2.1 Database schema

The analysis of the lithic assemblages relied on the use of a relational database in which every artefact corresponds to an entry and is identified by a numeric ID. Not all the artefacts were entered into the main database tables. Generally flakes smaller than 1 centimetre, undetermined fragments and debris were only counted and the total was recorded in a dedicated table. Thermally altered pieces were always sorted out and counted separately. Raw material determination of these classes was carried out only in a few cases. The threshold of 1 cm was calculated with respect to the presumed size of the blanks (both in length, width and thickness) necessary for producing the smallest microliths (never smaller than 4-5 mm in length). In some cases, mostly as a consequence of time constraints, some other (dimensional) classes of artefacts were only counted.

At a general level, three independent tables were created, one dedicated to debitage blanks, one to cores and the other for recording counted classes of artefacts. The structure of these tables was designed by adapting the database developed by F. Fontana for the study of Epigravettian assemblages, in order to account for Mesolithic specifities and the adopted methodology.

The following attributes were registered for the artefacts entered into the "debitage" table:

- General data such as ID number, site, layer, stratigraphic unit, square, year, etc.
- Integrity of the artefact. Possible values include complete, incomplete and the different types of fragments (e.g. proximal, lateral, . . .).
- Dimensional values in millimetres. Pieces were oriented according to the debitage axis. Width and thickness were measured on the mid portion of the artefact.
- Raw material. The lithotype or geological formation the chert belongs to.
- Cortex description. It includes multiple fields among which cortex percentage, position, type (calcareous, patina, etc.) and collection context (outcrop, slope deposit, soil, etc.).
- Technological interpretation. The attribution to a specific technological category such as blade/bladelet, flake, maintenance flake, etc., encompassing the entire reduction sequence. This field represents one of the most important attributes of this table and, to ensure standardisation, it is based on an editable value list with more than 40 options (cf. Appendix B).

- Orientation of previous removals with respect to the debitage axis.
- Morphology of the distal end. Possible values include normal, hinged, plunging and undetermined.
- Cross profile, as in the middle section of the blank. Values include rounded, triangular, trapezoidal, polyhedral and undetermined. This field has, generally, been compiled only for blades/bladelets.
- Outline. In this field the outline of the edges is recorded. Possible values are convergent, regularly parallel, irregularly parallel, irregular and undetermined. This field has, generally, been compiled only for blades/bladelets.
- Long profile. Value list include concave, rectilinear, sinusoidal, convex and undetermined. This field has, generally, been compiled only for blades/bladelets.
- Morphology of the butt.
- Trimming of the overhang.
- Knapping technique notes. In general this field has been used only to highlight peculiar features.
- Alteration. In this field all post-depositional alterations have been recorded, from thermal ones, to the presence of surface patina and edge scarring.
- Typological interpretation and description, subdivided into 3 fields. The 2 former were dedicated respectively to the classification, and to the description of eventual additional features (e.g. for triangles the description of the third side and of the 2 tips). The third field, accessory, contained the technological description of the retouch(es).
- Possible refitting and conjoining.
- Presence or absence of use-wear and type of microscopic analysis performed (only low or low and high power approach).
- Cleaning method for use-wear analysis.
- Edge and surface preservation state recorded in two distinct fields.
- Number of Zones of Use (ZU).
- Synthetic description of worked material and motion in two different fields.
- Additional notes concerning the artefact.

The recording of use-wear traces relied on the use of two dedicated tables. The former concerns impact fractures on microliths and is correlated to the debitage one via the numerical identifier of the piece. This table is structured as follows:

- Presence of impact fractures and certainty level.
- Fractures attested on the apical end (tip) of the microliths; the typology of the fracture, the termination and length of the languette, if pertinent, and the presence of spin-offs are registered in different fields.

- Fractures attested on the other end(s) of the microliths, according to the same scheme.
- Description of edge micro-scarring, if present.
- Description of MLIT, if present and if high-power approach was adopted.
- Additional notes.

The second table is dedicated to use-wear traces identified on retouched tools and unmodified blanks. As for the previous one, a relationship with the table "debitage" was created through the numerical identifier but, in this case, each record corresponds to a zone of use (ZU) and not to an artefact. This allows the recording of multiple ZUs per tool. In this table only general information and numerical values were entered (for statistical purposes). A detailed description of use-wear and taphonomic damages was done on a handwritten form featuring a sketch of the piece (Figure 3.1). Production, utilization and taphonomic features were codified with different colors in order to facilitate their distinction (respectively gray, blue and red). Additionally green was used to identify pictured zones.

The following attributes were recorded in the database table:

- Identifier of the ZU (numerical) and of the piece it was identified on.
- Integrity and position of the ZU.
- Description of the edge (profiles, retouched or natural, angle).
- Length of the ZU
- Motion and directionality
- Worked material
- Possible hafting modality

As regards cores they were recorded in an independent table because of the limited number of common fields. The attributes that were taken into consideration are the following:

- General data such as ID number, site, layer, stratigraphic unit, square, year, etc.
- Dimensional values in millimetres. Cores were oriented with the last striking platform upwards.
- Raw material. The lithotype or geological formation the chert belongs to.
- Cortex description. It includes multiple fields among which the type of cortex (calcareous, patina, etc.) and the collection context (outcrop, slope deposit, soil, etc.).
- Whether the blank on which the core was produced (possibly) is a flake was recorded on a dedicated field.
- Exploitation phase at the time of abandonment: initial stages, *plein débitage*, intensively exploited, undetermined.

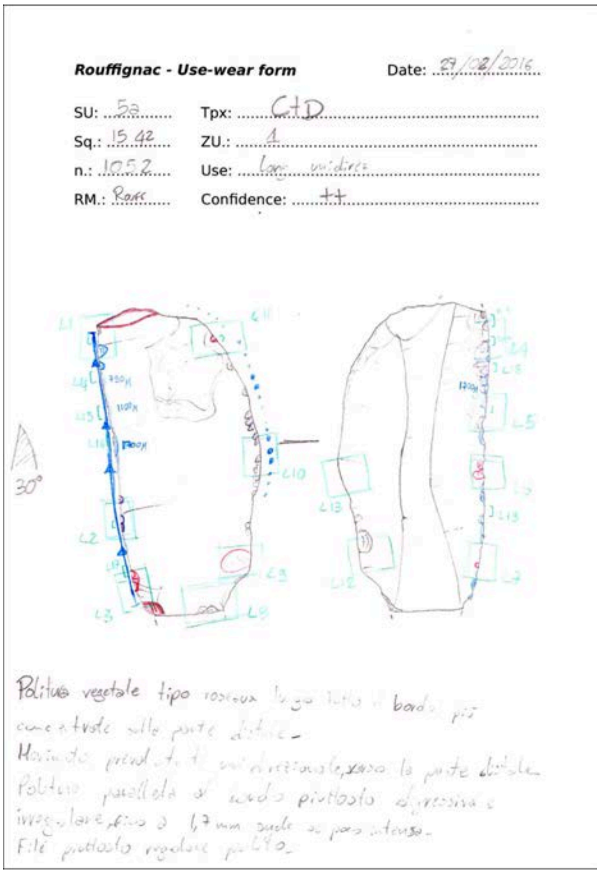

Figure 3.1: Example of the form used for the recording and description of use-wear traces.

- Objective of the production, such as bladelets, flakes, laminar flakes, mixed, etc.
- Length, width and type of last and second to last removals.
- Number and relative position of striking platforms.
- Number and relative position of debitage surfaces.
- Morphology of the last and second to last striking platforms.
- Angle between the last and second to last striking platforms with the respective debitage surfaces.
- Debitage rhythm on the last and second to last debitage surfaces.
- Trimming of the overhang of the last and second to last striking platforms.
- Knapping technique.
- Presence of a previous exploitation phase.
- Causes for the abandonment of the core.

- Typology of the core intended as a schematical description for a rapid indexing.
- Alteration of the core (thermal alteration, patina, etc.).
- Refitting pieces, if any are present.
- Additional notes.

3.2.2 Data elaboration and presentation

Data recorded through the above described relational database were elaborated and different tables corresponding to single fields or combinations of fields were created. Not all the outputs of this operation were kept for publication. In fact, it was decided to include in the manuscript only the most relevant and significant ones. Such decision is motivated by the necessity to synthesize collected information in order to facilitate the comparison of the results pertaining the single sites. For the same reason tables were preferred to charts being more precise and informative. As regards tables and in order to standardize the presentation of data, percentages were sistematically included also when meaningless because of the low size of the population. The only charts included in the site chapters are those regarding typometry. Common parameters used in univariate descriptive statistic were used to summarize dimensional values. These include both the description of the central tendency of the sample - mean, median, and mode - and its dispersion - range, quantiles and standard deviation. In the generic table included in each chapter, reporting the composition of the assemblages, all cortical and partially-cortical blanks were grouped with the exception of partially cortical maintenance blanks; in the category laminar blanks were included blades/bladelets, laminar flakes and all the laminar by-products not attesting cortical surfaces; the same rationale applies to flake blanks; fully maintenance blanks were counted separately.

Different programmes were used for the preparation of text and figures. The manuscript was redacted using Latex and Google Docs, while bibliography was managed with Mendeley Desktop and BibLatex. The database was created in Microsoft Office Access and data elaboration was performed creating dedicated queries or within a spreadsheet (Google Sheets). Basic descriptive statistics were calculated in Google Sheets, while for more advanced analyses and for the creation of charts the software R was used. As regards raster and vector graphic editing, GIMP and Inkscape were adopted. Spatial data were managed with QGIS and GRASS GIS. Raw data were provided by International Centre for Tropical Agriculture (SRTM; available from http://srtm.csi.cgiar.org); EMODNet Bathymetry portal (available from http://portal.emodnet-bathymetry.eu); Natural Earth portal (available from http://www.naturalearthdata.com) and Geoportale Nazionale (available from http://www.pcn.minambiente.it/GN/).

3.2.3 Reconstruction of raw material procurement strategies

Concerning the geological determination of exploited raw materials it should be pointed out that this study relied on the help of specialists, and in particular S. Bertola for the Italian area and G. Constans for the French one. This is motivated by the fact that a reliable application of this methodology claims for a detailed knowledge of regional geology and palaeogeographic evolution as well as of the micropalaeontological associations that characterize the different lithologies. It was my job to divide the artefacts into lithological groups according to their macroscopic aspect and microscopic texture and to assign them to the presumed contexts of collection on the base of cortical surfaces. In most cases the colleagues carried out the lithological attribution of the selected samples and developed hypotheses on the areas of provisioning. Especially as far as the Italian region is concerned I participated to several field-surveys organised by S. Bertola and aimed at collecting the geological samples used for comparing archaeological assemblages.

3.2.4 Technological notes

As regards the technological approach, the general principles and the specific features analysed were already described in the previous sections. Concerning the definition of products and by-products, it should be pointed out that in the former category were included blade/bladelets, laminar flakes and flakes as they "averagely" represented the main aim of the flaking process. Nonetheless other categories of blanks, notably semi-cortical and naturally backed blades/flakes, were produced in the process. Evidence from Sauveterrian assemblages suggests that these blanks were looked for and not only considered production wastes. In some cases, they were actually the main aim of specific phases of the production process, as it will be demonstrated in the following chapters. At the same time, they attest important technical procedures put in action for core maintenance and production prosecution. In light of this dual role they have been included in the production phase and classified as by-products. Blanks in which the component related to the initialisation or maintenance phases was deemed to be dominant, were excluded from this category and considered separately (e.g. opening flakes, surface or platform maintenance flakes, etc.). This does not exclude that such blanks could have been selected to be retouched or directly used in specific activities.

The distinction between flakes and blades/bladelets was done by adopting the generally accepted metric threshold (length being at least the double of width). The term laminar flake was used to indicate intermediate cases such as pieces with length/width ratio comprised between 1.5 and 2 (and clearly belonging to a laminar/lamellar production) or pieces that should have been considered as bladelets according to metric values but with highly irregular outlines. Moreover, it was decided to not adopt, *a priori*, metric subclasses for laminar blanks (e.g. micro-bladelets, bladelets, blades) considering that dimensional values would have allowed to identify eventual differences in the statistical distribution of the populations. It should also be noted that in the present work the terms reduction scheme and reduction sequence are used, respectively, as the English translation of *schéma opératoire* and *chaîne opératoire*, the former being the general and abstract concept, the latter the sequence of concrete actions.

Technological and typological analyses were extensively supported by low-power microscopic observation of the artefacts. Such an approach, that is not commonly adopted in these fields, is believed to be fundamental for a correct interpretation of the Mesolithic assemblages, and in particular for the technological study of the transformation phase. In this perspective, by combining the technological and functional viewpoints, it was possible to evaluate the real nature of retouches and in particular to purge the retouched artefacts assemblages by sorting out those pieces featuring either taphonomic or functional micro-scarring. This point is one of the most challenging aspect of the study of Sauveterrian assemblages. In fact, the intense transformation of the original blanks is limited to very few artefacts. In many cases it is difficult, with a solely macroscopic analysis, to discriminate and identify the origin of the modifications attested. Some authors include the pieces featuring use-induced removals in the retouched artefact assemblage. While it is true that they have been used as tools (*sensu lato*), these blanks never underwent the transformation phase of the lithic reduction scheme and should, thus, be distinguished.

3.2.5 Typological notes

Typological studies constitute the most numerous and extensive available references. Unfortunately, different typological lists and systems were adopted in the two analysed countries during the past decades. In southern France most researchers adopted the typological list designed by Rozoy (1968), featuring 119 morphotypes defined on the base of morphologic, morphometric and stylistic differences. Such a list was updated and implemented by the Groupe d'Études de l'Épipaléolithique-Mésolithique (Barrière et al., 1969, 1972; d'Etudes de l'Epipaléolithique Mésolithique, 1975). Other researchers adapted typological lists developed for Neolithic assemblages (Binder, 1987; Perrin, 2001) by including Early Mesolithic microliths. As regards northern Italy, Broglio and Kozlowski (1984) created a typological list based on the lithic assemblages of Romagnano Loc III. Other authors, on the other hand, continued to use the one proposed by Laplace (1964a). This inhomogeneity represents a strong limiting factor when comparing lithic assemblages studied with different methods. In many cases, in fact, it can be difficult to correlate the different types due to nominal and metric dissimilarities (i.e. differences in the adopted metric thresholds) as pointed out by Valdeyron (1994, 2008a) while attempting to compare French and Italian typological lists.

In line with the principles exposed in the first section of this chapter the typological analysis of retouched artefacts has been fused into the description of the technological transformation of lithic raw materials. In particular the modification of artefacts through retouch was included into a dedicated phase of the reduction scheme involving both blank selection and transformation. Retouched tools were analysed separately with respect to armatures. In the latter category were included all the microliths that are supposed to have functioned as part of composite tools. At a general level data analysis and presentation mostly aimed at highlighting which blank were selected and which parts and how were modified, here including retouch techniques and methods. The definition of the morphological/typological classes was reduced to a minimum and, as far as possible, only general descriptive terms were adopted, thus allowing their widespread understanding. Secondarily sub-groups were created on the base of recurrent morphological features. In particular microliths were substantially divided into backed points (including a few subtypes), crescents, scalene and isosceles triangles, backed (and truncated) bladelets and backed fragments. Moreover, an "under construction" category was adopted for all those microliths that either broke during their shaping out or were abandoned unfinished. Apart for burins and end-scrapers that represent well defined morpho-types, retouched tools were sorted primarily according to the type of retouch. Among pieces featuring an abrupt retouch only truncations, borers and backed knives were divided, while the others were included in a generic "backed pieces" class. Similarly among pieces featuring simple retouches, only pointed ones were sorted out. Pieces featuring a single notch or a denticulated retouch were considered as two separate categories, as were composite tools. Besides their classification, details on the type of blank selected and on the way they were modified through retouch have been reported in a synthetic descriptive way being parameters difficult to categorize in dedicated subclasses. Data concerning the latter, when necessary, have been recorded using the code proposed by Laplace, being an effective tool for the description of retouch morphology and position, although not meant for publication purposes.

3.2.6 Use-wear analysis

Since the publication of the English version of Semenov's "Prehistoric Technology" in 1964, use-wear analysis has much progressed and a standard protocol shared by most authors has been developed. During the 1970'ies, Tringham and Keeley developed Semenov's method in two different directions and a debate arose on the merits of the respective approaches. The one proposed by Tringham and, later, by Odell was named low power approach and mostly focused on the study of the morphology of micro-retouches with magnifications up to 100X (Tringham et al., 1974). Keeley (1980), on the other hand, emphasized other aspects of use-wear, such as polishes, and adopted a high power approach corresponding to higher magnifications (100-400X). Since the 1980'ies most authors started to incorporate the two methods that were, later, considered as complementary (Anderson-Gerfaud, 1981; Vaughan, 1981; Moss, 1983; Plisson, 1985; Mansure-Franchomme, 1986; Beyries, 1987; Van Gijn, 1989).

The methodology adopted for this work essentially follows up on this analytical protocol, that is currently applied by most traceologists (Van Gijn, 1989; González Urquijo and Ibáñez Estévez, 1994; Gassin, 1996; Rots, 2010; Philibert, 2002; Claud, 2008; Gueret, 2013b; Van Gijn, 2014). As a matter of fact the low power approach was favoured with respect to the high power one. In great measure this decision was forcefully taken because of the preservation state of some of the studied lithic assemblages, and in particular the ones belonging to older excavations. In these cases, it was generally preferred to limit the determination of worked materials to general hardness classes. This, although undoubtedly being a limiting factor did not represented too much of an hindrance in the framework of this work. In fact, with the aim of comparing two main Sauveterrian regions, it was believed to be more significant and informative to focus on tool general functioning modalities. Detailed analyses on very specific tools and activities were limited to few noteworthy cases (e.g. Rouffignac backed knives). Moreover, it was not possible to study all the assemblages both from a techno-typological and traceological point of view, *in primis* because of the great difference in the time needed. Some series were, thus, selected on the base of both scientific interests and logistical advantages. Fortunately, for some of the studied sites, functional data have already been published. These have been, as far as possible, incorporated within the newly done technological analyses.

The determination of worked materials and motions, was based both on bibliographic references and on the personal experience acquired studying the experimental series realized by S. Philibert, available at the University of Toulouse 2, and that of S. Ziggiotti. These bases were implemented by the development, although not yet comprehensive, of a personal reference series, mostly focused on the Italian chert lithotypes. Additionally, during the course of the PhD programme, a dedicated staying at the Laboratory for Material Culture Studies directed by A. Van Gijn, allowed focusing on the use-wear traces connected to the working of vegetal materials through the study of the considerable experimental series of the laboratory. Furthermore it was possible to attend the "Stage TRACEO 2015. Initiation à la tracéologie des outils pré-et protohistorique" which allowed gaining a wider perspective on use-wear analysis.

As regards impact fractures, the publication of numerous experimental programmes since de 1980ies allowed defining a series of particular features - i.e. some fracture types, edge scarring and MLIT - that can be considered diagnostic of the use of artefacts as projectiles (Fischer et al., 1984; Albarello, 1988; Gassin, 1996; Geneste and Plisson, 1990; Pétillon et al., 2011; Yaroshevich et al., 2010; Rots and Plisson, 2014). Furthermore, specific experimental programmes dedicated to Sauveterrian microliths were carried out (Philibert, 2002; Chesnaux, 2014a) and allowed gaining a specific knowledge on their damaging patterns and uncertainty thresholds. The identification of impact fractures was, thus, based on generalistic literature criteria implemented and refined by the indication issued from the above mentioned specific works.

3.2.7 Radiocarbon datings

All radiocarbon dates presented in the text have been calibrated with OxCal 4.2 (Bronk Ramsey, 2009), using the calibration curve IntCal13 (Reimer et al., 2013). Dates have been calibrated with respect to present (year 1950, cal BP), using the 2σ (95.4%) confidence level. In appendix A all the radiocarbon datings identified in bibliography were reported, whitout any selection based on standard error. The pertinency of the most significative datings was discussed in Chapter 2.

Chapter 4

Grotte de Rouffignac

Contents

4.1 Site introduction

At the entrance of Rouffignac cave (Figure 4.1), located in Périgord (Municipality of Rouffignac, Nouvelle-Aquitaine region, south-western France), a Mesolithic sequence was brought to light by Claude Barrière during his excavations carried out from 1957 to 1962 (Barrière, 1972). The cave entrance is located at about 200 meters a.s.l. on the mid part of a south-east facing slope. The discovery of the prehistoric site dates back to first half of the 20th century, when C. Plassard, during some amenagement works identified some potsherds. In 1956 L.R. Nougier and R. Robert discovered the Palaeolithic parietal artworks for which the cave is mostly famous and were shown the above mentioned potsherds. The following year C. Barrière started the excavation of a large trench-pit (48 m^2 on the upper levels). Data concerning the methodology adopted during the excavation are scarce. Barrière divided the investigated area into square meters and recorded the position of the most important artefacts (cf. Barrière, 1972), while for the great majority of blanks no spatial data are available. Unfortunately sediment was not sieved and, as appears clearly by the study of the lithic assemblages, a great part of the smaller blanks was lost (presumably flakes, *débris* and microliths smaller than 1 cm).

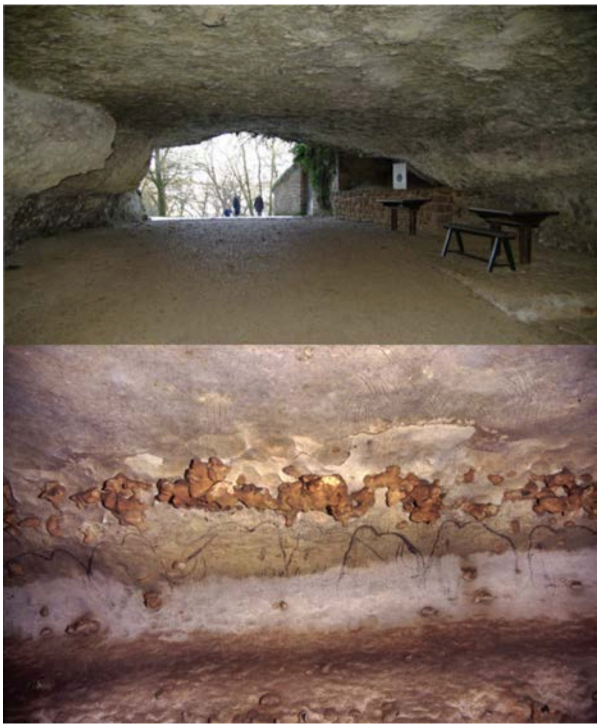

Figure 4.1: The entrance of the Rouffignac cave (up) and the detail of a cave wall rich in chert nodules (photo F. Plassard)

A six metre thick stratigraphic sequence was brought to light, composed by five main levels. The three lower ones were attributed to the so-called "Epipalaeolithic" (layers 5 and 4 to the Sauveterrian and layer 3 to the Tardenoisian), while the other two feature numerous artefacts and burials spanning between the Copper and Middle Age. Layer 5 - the lowermost one - was identified only in the inner part of the trench (inside the dripline) and covered a small surface (less than 6 m^2) with respect to layer 4 that continued outward. During the excavation it was divided into 2 sub-levels (5a and 5b), while layer 4 into 3 (from 4a to 4c). These layers were dominantly composed by clayish sediments intercalated to various combustion structures in which ashes and charcoal were abundant (Barrière, 1972). One of these structures, belonging to layer 5b, was described as a structured hearth with a stone-built concave base. The excavation of the structure filling revealed different phases of use. For two of them the presence of numerous burnt hazelnuts is reported. Six postholes associated to layers 5b, 5a and 4c were also identified during the excavation.

From a taphonomic point of view it should not be overlooked that the Mesolithic sequence underwent several natural and anthropic processes that partially compromised its integrity. As reported by Barrière (1972) runoff waters intensively excavated the sector comprised between the dripline and the inner part of the cave, partially destroying the lower levels. Additionally the presence of some badger burrows is also attested.

The five Early Mesolithic layers were dated by Barrière and results are reported in Table 4.1.

The excavation yielded very rich lithic assemblages, in particular as regards layer

Table 4.1: Rouffignac, layers 5 and 4. Available radiocarbon datings.

Layer	Laboratory Identifier	Radiocarbon date	Calibrated age (2σ)
L. 4a	GrN - 2913	8370 ± 100	9538-9094 cal BP
L. 4b	GrN - 2895	8590 ± 95	9889-9433 cal BP
L. 4c	GrN - 2880	8995 ± 105	10,400-9744 cal BP
L. 5a	GrN - 5513	8750 ± 75	10,136-9545 cal BP
L. 5b	GrN - 5514	9150 ± 90	10,560-10,185 cal BP

4, that were studied by Barrière (1972, 1973) and Rozoy (1978) essentially from a typological point of view. Because of the presence of elongated backed points and triangles, both authors interpreted layer 5 and 4 as typical Sauveterrian assemblages. After these early studies, the analysis of the assemblages was abandoned. In 2011 the Rouffignac backed knives belonging to layer 5b were the object of a preliminary use-wear analysis carried out by H. Guilbault (2011) in the framework of her Master thesis.

Bone industry, on the other hand, is scarce. A recent revision revealed that only 11 artefacts belonging to layer 5 and 4 were actually intentionally modified (Marquebielle, 2014). Remarkable is the presence of two engraved artefacts, interpreted as smothers by Barrière. The other artefacts are represented by a bevelled piece, a handle-like element, an owl, a possible smother and a few production wastes.

Faunal remains are quite scarce and mostly represented by wild boar. Red deer, roe deer, *Canis* sp., wild cat, badger and *Martes* sp. are only attested by one or two specimens. Other palaeoenvironmental data were obtained through the analysis of pollens. Unfortunately taphonomic processes as well as the intense combustion activity that characterize some of the layers destroyed most of the pollen record. Determinable pollens were, thus, very few and results should be considered very carefully. At a general level the stratigraphic series shows the disappearance of cold species such as *Betula* and *Pinus* and the rapid diffusion of a deciduous forest dominated by *Corylus*, *Alnus* and *Ulmus*. It is also interesting to note the relatively high presence of *Graminacee* in layer 5b.

In 2003 a new archaeological excavation led by F. Plassard and M. Dachary took place several hundreds meters inside the cave (Dachary et al., in press). A lithic scatter located in correspondence of an engraved mammoth was investigated. The radiocarbon dating of a charcoal sample, indicates that the two features are not coeve as the lithic scatter was attributed to the Mesolithic (cf. *infra*).

4.2 The lithic assemblages

The lithic assemblages belonging to the two lowermost sublayers - 5b and 5a - were analyzed. They are respectively composed of 1981 and 5857 artefacts. Details are reported in Table 4.2.

As regards preservation state a major difference can be highlighted between the two layers. In the oldest one the percentage of burnt artefacts is attested around 37% (Table 4.3). In the most recent one, on the other hand, burnt artefacts constitute almost 80% of the total. Similarly also the number of undetermined fragments (Table 4.2) is very high and in layer 5a it reaches more than half of the total. In great measure these are represented by undetermined burnt fragments, although other mechanical

Table 4.2: Rouffignac, layers 5b and 5a. Composition of the lithic assemblages.

	L. 5b		L. 5a	
Cortical and semi-cortical blanks	264	13.6%	307	5.3%
Laminar blanks	362	18.6%	971	16.7%
Flake blanks	418	21.5%	820	14.1%
Maintenance blanks	61	3.1%	93	1.6%
Burin spalls	5	0.3%	23	0.4%
Undetermined fr.	715	36.7%	3376	58.0%
Flakes < 1 cm	2	0.1%	24	0.4%
Retouched blanks	104	5.3%	136	2.3%
Transformation wastes	17	0.9%	66	1.1%
Cores	33	1.7%	41	0.7%
Total	1981	100%	5857	100%

processes certainly participated in increasing this number. The same trend can be appreciated also when considering diagnostic elements entered into the database (Table 4.4): in layer 5a the number of fragmented and incomplete artefacts increases drastically.

Table 4.3: Rouffignac, layers 5b and 5a. Thermal alteration of the artefacts.

	L. 5b		L. 5a	
Unaltered	1247	62.9%	1244	21.2%
Thermally altered	734	37.1%	4613	78.8%

Table 4.4: Rouffignac, layers 5b and 5a. Integrity of the artefacts entered into the database.

	L. 5b		L. 5a	
Entire	655	53.0%	280	23.7%
Incomplete	201	16.3%	377	31.9%
Fragments	379	30.7%	526	44.5%
Total	1235	100%	1183	100%

All the artefacts have been analysed from a techno-economical and typological perspective while use-wear analysis was mostly focused on retouched tools and microliths belonging to both layers and on a sample of unretouched blanks from layer 5b.

4.3 Raw material provisioning

One of the peculiar aspects of Rouffignac cave is the presence of rich outcrops of chert. This strictly local raw material was exploited quite intensively during prehistoric times as testified by the numerous clusters of knapping wastes - mostly composed of cortical and semi-cortical flakes - lying, together with charcoal remains, on the cave floor or at the bottom of the numerous bear wallows. The excavation carried out by F. Plassard and M. Dachary in 2003 of one of these clusters, located several hundreds meters inside the cave, allowed its association to the Early Mesolithic layers attested at the entrance of the cave by means of radiocarbon dating (Dachary et al., in press). According to their technological analysis, the large blocks were detached from the rock face or collected in the residual soil of the cave and immediately tested. If judged to be sound enough, they were partially decorticated and the low-quality parts were removed prior to their exportation elsewhere, presumably at the entrance of the cave. Otherwise they were discarded. Outcropping chert, in fact, comes as very large blocks (up to several decimetres) but its quality and degree of silicification are variables and the presence of numerous fractures does not allow their optimal exploitation. Moreover cortical surfaces are often quite thick (often more than 10 mm), representing an hindrance for the direct exploitation of the blocks.

The lithic assemblages of layer 5b and 5a are almost entirely composed of Senonian yellowish gray, gray and dark greyish cherts that correspond to the lithotypes that can be found within the cave. According to Barrière (1972) the yellowish grey one can be found, for example, in the sector of the cave named "*Grand Plafond*" and the darker ones in the gallery "G", near the "Grande Fosse". These two locations, anyways, cannot be considered as the sole outcrops and more detailed prospection aimed at verifying the actual variability of chert texture and colour inside the cave are needed. Moreover similar lithotypes also outcrop on the terraces and slopes surrounding the cave entrance (F. Plassard, pers. comm.). The analysis of the cortical surfaces on archaeological blanks indicates that more than half of the artefacts made with the presumed cave raw material were indeed collected in primary deposition within the cave or in secondary deposition within its very reddish residual soil (Table 4.5). Although with low percentages some slightly or well rounded cortical blanks are also attested and testify the complementary collection of blocks and cobbles along the nearby slopes and stream. Additionally in both layers a low number of artefacts (32 in layer 5b and 19 in layer 5a) were obtained from a yellowish chert that, although belonging to the same geological formation, because of its textural and colorimetric properties, it is believed to come from outside the cave.

Non strictly local raw materials were identified only in the assemblage of layer 5a. These are represented by 11 artefacts realized with a very fine dark Turonian chert ("Bergerac" type) that outcrops near the Fumel village, around 55 kilometres to the south of the cave (G. Constans, pers. comm.). Most of these blanks are represented by well crafted, regular bladelets and semi-cortical bladelets that seem to testify the introduction in the site and partial exploitation of a single core. Additionally 18 artefacts and 2 cores were realized on greenish Jurassic cherts (G. Constans, pers. comm.) and were collected in soils or along river beds. It can be surmised that such raw material could be collected along the course of the river Dordogne that lies around 20 kilometres to the south of the site.

4.4 Reduction schemes

The exploitation of lithic raw materials at the entrance of the cave was strictly connected with the on-site abundance of large cherty blocks. The analysis of the lithic assemblages revealed that two reduction schemes were put in place. The first one was aimed at the exploitation of large blocks (around 15-20 cm) for the obtention of both laminar

Table 4.5: Rouffignac, layers 5b and 5a. Provenance contexts of exploited Senonian raw material derived by the analysis of residual cortical surfaces.

	L. 5b		L. 5a	
Cave	156	53.4%	58	55.8%
Alluvial deposit	1	0.3%	1	1.0%
Slope deposit	22	7.5%	4	3.8%
Undeterminable	113	38.7%	41	39.4%
Total	292	100%	104	100%

and lamellar/flake products (Table 4.6). The latter represent also the aim of the second reduction scheme that started with smaller blocks or cobbles (around 7-10 cm).

Table 4.6: Rouffignac, layers 5b and 5a. Products and by-products.

	L. 5b		L. 5a	
Main products	**691**	**67.4%**	**1665**	**80.7%**
Blades/bladelets	285	41.2%	724	43.5%
Laminar flakes	26	3.8%	177	10.6%
Flakes	380	55.0%	764	45.9%
Laminar by-products	**130**	**12.7%**	**151**	**7.3%**
Semi-cortical blades	57	43.8%	52	34.4%
On edge blades	4	3.1%	2	1.3%
Semi-cortical on edge blades	4	3.1%	4	2.6%
Naturally backed blades	47	36.2%	68	45.0%
Cortical naturally backed blades	18	13.8%	25	16.6%
Flake by-products	**204**	**19.9%**	**247**	**12.0%**
Semi-cortical flakes	149	73.0%	148	59.9%
Naturally backed flakes	38	18.6%	56	22.7%
Cortical naturally backed flakes	17	8.3%	43	17.4%
Total	1025	100%	2063	100%

4.4.1 Initialisation

Blocks were probably imported on-site already partially decorticated as testified by the low number of cortical (Table 4.7) and semi-cortical (Table 4.6) blades and flakes. It is quite likely that most of the raw material was directly procured in the inner part of the cave as testified by the dozens lithic scatter that are disseminated on the cave floor. Data derived from the technological analysis of the lithic assemblage retrieved during the excavation carried out by F. Plassard and M. Dachary fully support this hypothesis (cfr. Site introduction). The incompleteness of the excavated area and the lack of extensive researches and excavations inside and outside the cave, on the other hand, do not allow a quantitative assessment of this phenomenon. Part of the blocks were, in fact, procured on the terraces and slopes surrounding the cave entrance and in the absence of cortical surfaces it is difficult to distinguish the two of them. Moreover also smaller blocks were collected (Table 4.5).

In all cases the initialisation of the debitage was direct and natural ridges and convexities were exploited with absolutely no shaping-out phase. The sole initialisation blanks are represented by opening blades and flakes along with some naturally crested blades. The only blank attesting a more careful preparation is represented by a partially crested blade coming from layer 5b.

Table 4.7: Rouffignac, layers 5b and 5a. Initialisation blanks

	L. 5b		L. 5a	
Partially crested blades	1	5.3%		
Opening blades			3	8.6%
Naturally crested blades	6	31.6%	4	11.4%
Opening flakes	7	36.8%	6	17.1%
Generic cortical flakes	5	26.3%	22	62.9%
Total	19	100%	35	100%

4.4.2 Production

The first stage of the first reduction scheme sees the production of few large laminar flakes and blades - spanning from around 45-50 mm to 140 mm in length and featuring long cutting edges - from the larger blocks introduced into the site. Production, at this stage, does not seem to be standardised and carefully controlled, as demonstrated by the irregular morphology of the blanks. More likely these products were obtained by opportunistically exploiting existing ridges and convexities for the detachment of short series of elongated blanks. Debitage rithm is generally unidirectional, less frequently bidirectional and orthogonal removals are attested. These products are characterized by thick butts and the overhang is not generally trimmed or, less frequently, only roughly trimmed. These features and the well developed percussion marks on the butts suggest that they were obtained by direct percussion with a stone hammer. The direction of the strikes was not tangential to the platform but aimed at striking a few millimetres to the inside of the overhang, thus allowing the removal of blanks without the need to continually maintain the overhang. Such morphology is consistent with the technique named as "*style de Rouffignac*" by Barrière (1972) and Rozoy (1978).

Along with the obtention of a relatively low number of the above mentioned blanks, the main aim of this phase was the rapid reduction of the blocks into smaller ones to be used for the production of bladelets and flakes. This aim was pursued through two alternative technical solutions. In the first one, more commonly attested in the assemblage of layer 5b, large flakes were removed by means of the same direct percussion technique. These flakes were then used as cores in the following phase. The second one sees the use of fire for the fracturation of blocks (see Section 4.5). This technique seems to be the preferred choice as far as layer 5a is concerned although the former one was not completely abandoned.

The second phase concerns the exploitation of the small blocks obtained with the two above described technical solutions. The aim of this phase is the direct production of a wide range of blanks, such as bladelets, laminar flakes and flakes whose length is generally no longer than 40 mm (Table 4.8; Figure 4.2). Bladelets are characterized by triangular or trapezoidal sections (respectively 59-43% and 28-23% in the two layers) and slightly irregular edges. These products were mostly obtained through unipolar

Table 4.8: Rouffignac, layers 5b and 5a. Summary of the metric values of debitage laminar products and by-products (A = blades, B = by-products).

		L. 5b		L. 5a	
		A	B	A	B
Length	Min.	13	19	10	22
	1st Qu.	27	32	26	29
	Median	34	44	31	37
	Mean	35.29	46.75	32.82	37.96
	3rd Qu.	40	56.5	37	43
	Max.	90	105	80	70
	σ	12.44	19.69	9.31	11.17
	Count	165	84	326	81
Width	Min.	2	4	2	4
	1st Qu.	10	12	10	10.5
	Median	13	15	12	14
	Mean	13.66	16.29	13.59	14.34
	3rd Qu.	16	19	16	17
	Max.	44	40	40	33
	σ	5.51	7.04	5.11	5.51
	Count	309	129	646	151
Thickness	Min.	1	1	1	1
	1st Qu.	2	3	2	3
	Median	3	5	3	4
	Mean	3.24	5.7	3.27	4.84
	3rd Qu.	4	7	4	6
	Max.	12	23	16	14
	σ	1.69	3.38	1.67	2.62
	Count	311	130	651	151

sequences of removals. Maintenance elements are not abundant. In both layers a few neo-crested and partially neo-crested bladelets are attested (Table 4.9). The orthogonal reorientation of the cores is testified by some reorientation blades, and in particular by proximal ones (extracted along the overhang). The former are attested particularly in layer 5a and one of them shows the inversion between the debitage surface and the striking platform. Surface maintenance elements are mostly represented by flakes and, secondary, blades detached from the same platform. Significative evidence of the maintenance of the striking platforms is attested only in layer 5a while in the older one only by two blanks (among which a *tablette*) are present.

As regards knapping techniques the one described for the first phase is still attested although the majority of the laminar artefacts features a trimmed overhang, a higher standardization and a morphology of the butt that is consistent with a tangential soft stonehammer percussion.

The second reduction scheme starts with the exploitation of smaller blocks and cobbles (around 60-70 mm). Among them the blanks in different raw materials, such as the ones collected on the nearby streams and riverbeds, are accounted. This second reduction scheme fully corresponds to the second phase of the first one and cores were exploited in the same way. At a general level a more careful and controlled

Figure 4.2: Rouffignac, l. 5b-5a. Scatterplot of length and width values of products, by-products and core last removals (hinged ones excluded). For layer 5a flake products and by-products were not individually measured.

exploitation of these raw materials can be highlighted as testified by the presence of higher percentages of regular lamellar blanks with respect to by-products.

4.4.3 Core analysis

Totally 33 cores were identified in layer 5b and 41 in layer 5a. The negatives of the last removals on core debitage surfaces indicate that bladelets were the main aim of the production (Table 4.10). This objective is not exclusive as cores oriented to the production of laminar flakes and flakes are also attested.

As regards the original blank morphology in the oldest layer the greatest part of them is represented by large flakes (75.8%) (Figure 4.3 and 4.4). This percentage decreases in layer 5a to 24.4% (10 cores). 4 possible flake-cores should be added to this count. Moreover in the latter layer also the number of undetermined pieces is higher (26.8% with respect to 12.1% of layer 5b). Respectively 4 and 16 cores are the results of the reduction of block fragments and cobbles. A detailed analysis of the morphology of natural surfaces allowed to determine that 14 cores belonging to layer 5a (34.1%) were obtained by flaking fire-cracked block fragments (cf. Section 4.5). For layer 5b the application of this technique for the fragmentation of larger blocks could only be surmised but not confirmed and eventually involved a much lower number of artefacts.

In both layers most of the cores feature singles debitage surfaces (Table 4.11) and

Table 4.9: Rouffignac, layers 5b and 5a. Maintenance blanks.

	L. 5b		L. 5a	
Neo-crested blades	6	9.8%	4	4.3%
Partially neo-crested blades	5	8.2%	3	3.2%
Proximal reorientation blades	3	4.9%	8	8.6%
Reorientation flakes	13	21.3%	1	1.1%
Surface maintenance blades	3	4.9%	8	8.6%
Naturally backed surface maintenance blades	1	1.6%	4	4.3%
Maintenance blades from opposite st. platform			1	1.1%
Surface maintenance flakes	20	32.8%	26	28.0%
Naturally backed surface maintenance flakes			6	6.5%
Maintenance flakes from opposite st. platform	1	1.6%	1	1.1%
Tablettes	1	1.6%		
Striking platform maintenance flakes	1	1.6%	9	9.7%
Generic maintenance flakes	7	11.5%	22	23.7%
Total	61	100%	93	100%

striking platforms (Table 4.12). Cores featuring more than 3 debitage surfaces and/or striking platforms are, also, well attested. It is interesting to note that cores with two opposite striking platforms exploiting the same debitage surface are more abundant in the oldest layer. In the more recent one, on the other hand, cores with two orthogonal striking platforms exploiting different surfaces are well represented. Moreover in the latter a wider set of solutions is attested by the presence of single artefacts.

Table 4.10: Rouffignac, layers 5b and 5a. Objective of the production attested by core last removals.

	L. 5b		L. 5a	
Bladelets	20	60.6%	23	56.1%
Laminar flakes	7	21.2%	8	19.5%
Flakes	3	9.1%	1	2.4%
Mix	2	6.1%	8	19.5%
Undetermined	1	3.0%	1	2.4%
Total	33	100%	41	100%

As regards cores realized on flakes, the striking platform was mostly located in correspondence of the ventral surface and debitage started from the distal end of the flake, with a *semi-tournant* rhythm, resulting in an endscraper like morphology (respectively 14 and 7 cores). Flake-cores were also exploited as burin-like cores (respectively 2 and 2) or through facial removals on the ventral surface (respectively 4 and 1). In some cases these cores were more intensively flaked and rotated in the same way cores realized on blocks were. It is interesting to note that fire-cracked blocks were used in the same way as large flakes, thus reinforcing the assumption of the alternativity of the two technical solutions. In fact, the striking platform was localized in correspondence of one fracture-obtained surface that can be assimilated to the ventral face of a flake.

Most of the cores were abandoned during the production phase (78.8% and 65.9%)

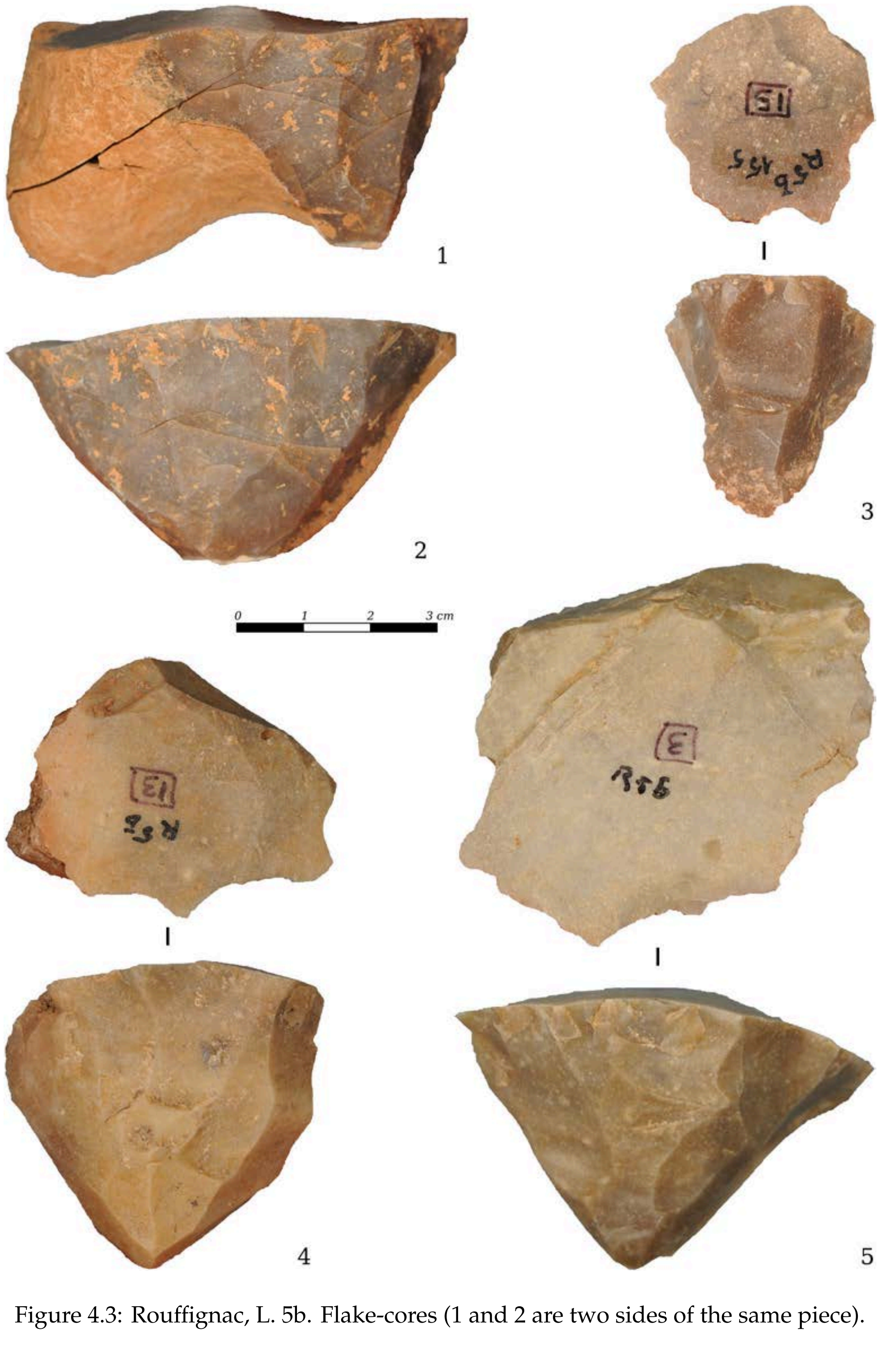

Figure 4.3: Rouffignac, L. 5b. Flake-cores (1 and 2 are two sides of the same piece).

Figure 4.4: Rouffignac, L. 5b. 1, flake-core. 2-8, laminar and lamellar products.

Table 4.11: Rouffignac, layers 5b and 5a. Number and relative position of debitage surfaces.

	L. 5b		L. 5a	
One	23	69.7%	22	53.7%
Two consecutive	2	6.1%	9	22.0%
Two opposite	1	3.0%	2	4.9%
Three or more	6	18.2%	8	19.5%
Undetermined	1	3.0%		
Total	33	100%	41	100%

Table 4.12: Rouffignac, layers 5b and 5a. Number and relative position of striking platforms (ds = debitage surface).

	L. 5b		L. 5a	
One	20	60.6%	19	46.3%
One +1 peripheric			1	2.4%
One +1 secondary	1	3.0%	1	2.4%
One +2 secondary			1	2.4%
Two opposites - same ds	5	15.2%	2	4.9%
Two opposites - diff. ds			1	2.4%
Two orthogonal - diff. ds	1	3.0%	7	17.1%
Two orthogonal +1			1	2.4%
Three			1	2.4%
More than three	5	15.2%	7	17.1%
Undetermined	1	3.0%		
Total	33	100%	41	100%

and generally no clear evidence of technical problems could be detected. In some cases the abandonment of the cores coincides with the detachment of a hinged removal. Intensively exploited cores are few (12.1% and 24.4%) and those abandoned in the earliest phase of the flaking process even less numerous (6.1% and 9.8%).

4.5 Heat fracturing of cherty blocks

During the analysis of the lithic assemblage of layer 5a some surfaces that are supposed to have been originated by a thermal fracturation of the blocks were sorted out (Figure 4.5). The identification was mostly carried out on the base of morphological features and the comparison with the results of two preliminary experimental programmes. Data currently available already allow to prove, without any doubt, that this technique was applied on the site. Anyways, more detailed and precise archaeometric analysis will be carried out in the near future, in order to precisely assess the technical procedure and identify, among others, temperature and exposure time.

The application of heat treatment to cherty raw material has been identified since the 1960'ies in Middle and Upper Palaeolithic, Mesolithic and Neolithic contexts (Crabtree and Butler, 1964; Bordes, 1969; Binder, 1984; Tixier and Inizan, 2000; Léa,

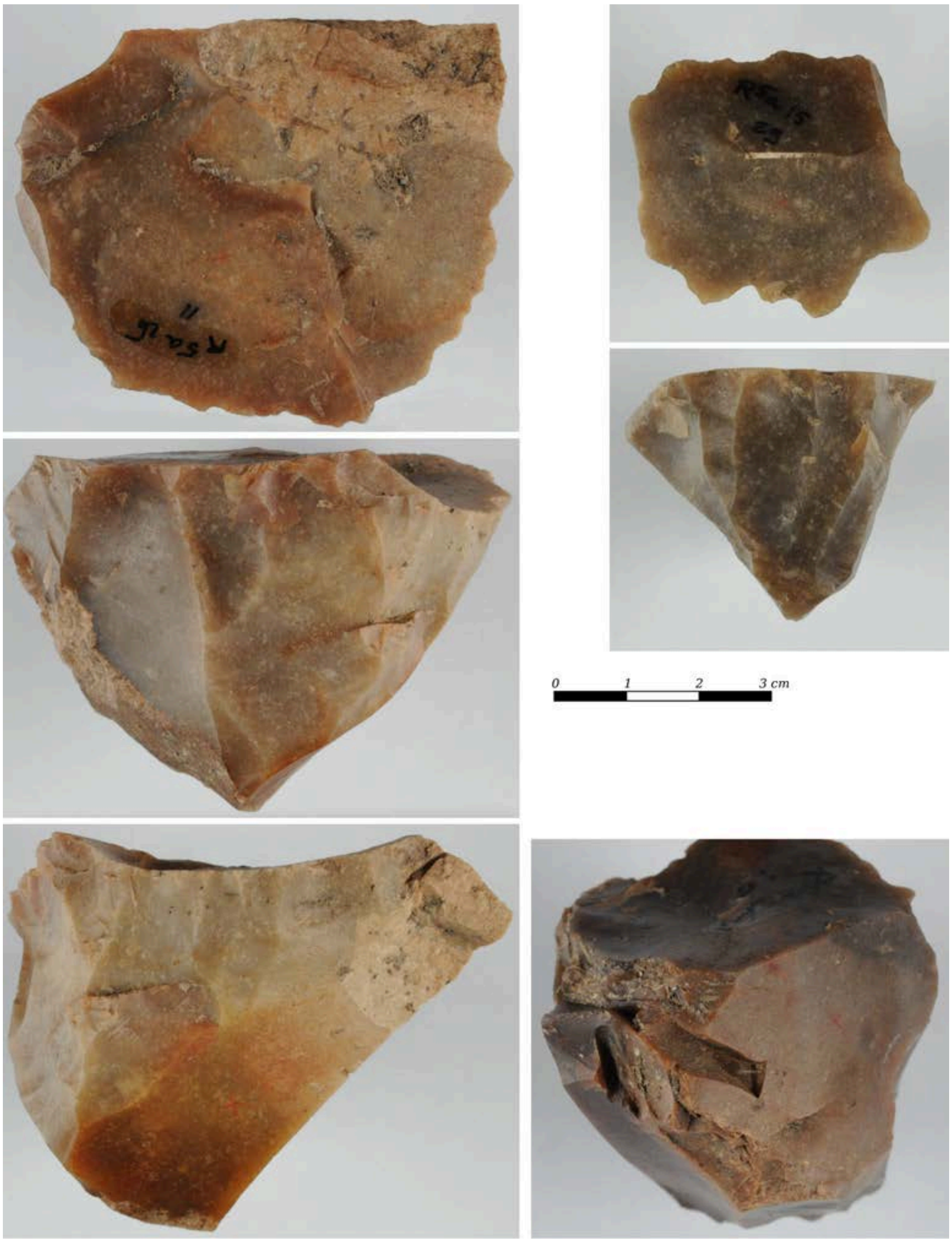

Figure 4.5: Rouffignac, L. 5a. Cores attesting evidence of heat-fracturing.

2005; Eriksen, 2006; Brown et al., 2009; Mourre et al., 2010; Roque-Rosell et al., 2011; Porraz et al., 2013; Schmidt et al., 2013b). In most cases this technique seems to be connected to pressure flaking, either as regards retouch and transformation of blanks or for the production of laminar products. Heat-treatment of silica rocks is a controlled process that involves a structural and crystallographic transformation that alter the material's fracture properties (Schmidt et al., 2013a,c, 2016) and is aimed at improving knapping suitability.

Heat fracturing, on the other hand, is due to a physical stress that is thermally induced and that produces cracking and shattering of blocks (Mercieca, 2000). Such a technique is not as well known as heat-treating and experimental, as well as archaeological references are still very few (Mercieca, 2000; Guilbert, 2001). In most cases the identification of heat fractures on archaeological lithic assemblages relies on the presence of typical features such as colour variations, pot-lidding and surface crazing and is interpreted as the result of either failed attempts to heat treat or accidental fire exposures. The intentional application of this technique to siliceous raw-materials was proposed by Guilbert (2001) for two Early Mesolithic sites of South-Eastern France. According to the author heat fracturing was functional to the obtention of small blocks to be used as cores. The diagnosis of the technique was based on a series of refitted assemblages testifying the flaking of fire altered fragments of chert and the presence of a greasy lustre on some surfaces, notably the negatives of flakes detached after heat exposure. This latter feature, anyways, was reported to be well identifiable only on the cores. In fact, although the presence of a greasy lustre on flaked surfaces has always been considered as the most distinctive heat-induced change visible to the naked eye (Domanski and Webb, 1992), only a small percentage of flakes may have this lustre (Collins, 1973) and post-depositional effects like weathering and bioturbation could remove it (Price et al., 1982).

Actually during the present study it was noted that heat induced fractures attested in the archaeological material have a most peculiar morphology that allow their identification also when the greasy lustre is not clearly recognizable. These are consistent with the fractures obtained during two preliminary experimental attempts to shatter large blocks of chert. The experimental tests were carried out with three different lithologies: a very fine grained Cretaceous chert belonging to the Maiolica formation, outcropping in the Monti Lessini (northern Italy), a Turonian chert from the Bergerac region and a Senonian chert from central France. All the blocks started to exfoliate almost immediately after being put in contact with fire. In particular the lower surface and the sides were the ones interested by this phenomenon. After very few minutes - around 5 to 10 - major fractures started to develop. The only parts that attested typical traces of thermal alteration were the ones directly in contact with the embers while the core of the block, although fissured, did not present any major modifications. The Bergerac chert, with respect to the others, shattered in much smaller pieces and suffered of an intense pot-lidding. At a general level, for the technique to work smoothly, fire temperature has to be sufficiently high. Otherwise fracturation process is much slower and thermal alteration of the chert affects an higher percentage of raw material.

The chunks obtained during the experiments have different sizes, from 10 x 5 x 5 cm (smaller ones were discarded) to 15 x 15 x 11 cm and, generally feature, at least, one cortical surface or an exfoliated one. Morphology of the fragments is influenced by the shape of the original block. Most recurrent morphologies are represented by irregular triangular and rectangular prisms. Surfaces are characterized by the alternance of concave and convex portions, with thick hackles developed from the center outwards.

In the presence of raw material irregularities the fracture surface assumes a deformed aspect but do not present a clear directionality as happens with flaked ones. In some cases these features are combined together forming flake-like blocks characterized by a butt, a ventral and a dorsal aspect attesting the negatives of false previous removals that are actually other fracture surfaces. As regards the ventral face of these flake-like blanks, it is not uncommon that a bulb-like convexity develop next to one of the sides of the block and the undulated fracture that connect the two surfaces forms a lip-like morphology. Moreover, in such a case, the above mentioned hackles are generally located around the bulb and along the external edges of the blank. Although these features resemble those identifiable on actual flakes, it is easy to feel that something is off and that things are not exactly as they should be. At the same time, when dealing with archaeological, partially flaked blanks their identification is not always that clear and heat produced fractures can easily be mistaken for flake ventral faces.

As regards the archaeological assemblages of Rouffignac, clear evidence of the application of this technique has been identified only on cores. Debitage products and wastes derived from heated blocks could not be sorted out from the rest because of the lack of diagnostic features. In some cases a faint lustre could be appreciated on some flaked surfaces but it was not deemed to be completely reliable and diagnostic. 14 cores (34.1%) belonging to layer 5a attested evidence of heat fracturing. In most cases such an evidence is represented by the uneven presence of greasy lustres and by the specific morphology of some surfaces. In two cases the fact that the blocks were already thermally altered before their flaking is, undoubtedly, attested by some removals stopping in correspondence of minor heat produced fractures. As regards layer 5b, the number of cores with heat fracturing evidence was reconstructed *a posteriori* as the analysis of this layer was already concluded at the time of the first identification of the technique and the material already returned to the deposit. At a preliminary level, at least, 4 cores (12.1%) were realized on heat fractured chunks of chert. Although this number could be slightly underestimated, the preferential use of actual flakes as core blanks with respect to block fragments during this occupational phase is undeniable and seems consistent with the general composition of the assemblage. A possible correlation between heat fracturing technique and the very high percentage of undetermined burnt fragments yielded by layer 5a (57.6% vs. 36.1% of layer 5b) can, in fact, be surmised.

4.6 Blanks selection and transformation

4.6.1 Microlithic armatures

While analyzing microliths, it should not be forgotten that during the excavation sediment was not systematically sieved and, thus, the total number of retouched artefacts is probably biased. This is particularly evident for layer 5b that yielded only 18 microliths.

Blanks selected for the production of microlithic armatures are mostly represented by bladelets (Table 4.13). In layer 5a they represent 62.5% of the microliths. Among the other selected blanks laminar flakes and naturally backed bladelets are also attested. For a high percentage of microliths, due to retouch intensity, it was not possible to ascertain the exact type of blank they were manufactured with and were thus attributed to a generic category. This means the importance of flakes and other by-products could be underestimated.

Table 4.13: Rouffignac, layers 5b and 5a. Blanks selected for the production of microlithic armatures

	L. 5b		L. 5a	
Bladelet	8	44.4%	60	62.5%
Bladelet/flake	10	55.6%	31	32.3%
Laminar flake			3	3.1%
Nat. backed bladelet			2	2.1%
Total	18	100%	96	100%

Table 4.14: Rouffignac, layers 5b and 5a. Wastes of the transformation phase.

	L. 5b		L. 5a	
Proximal microburins	10	58.8%	40	60.6%
Distal microburins	5	29.4%	18	27.3%
Fractured notches	2	11.8%	7	10.6%
Krukowski microburins			1	1.5%
Total	17	100%	66	100%

For the production of microliths - both backed points and triangles - the microburin technique was extensively applied. This is well attested both by the presence of residual portions of the *piquant-trièdre* on the microliths and by some microburins (Table 4.14). Proximal microburins are more numerous than distal ones totaling around 60% of retouch wastes in both layers. The laterality of the notch has been registered for the artefacts belonging to layer 5a. In most of the proximal microburins the notch was manufactured on the right side (n. 28, 70.0% of proximal microburins) while in most of distal ones on the left side (n. 14, 77.8%). The presence of a *piquant-trièdre* was identified on 2 proximal backed points with natural base and 16 triangles. In two of the latter the *piquant-trièdre* was, actually, present on both ends of the artefacts.

From a typological point of view the assemblage of layer 5b is equally composed of backed points and scalene triangles (Table 4.15; Figure 4.6). Two backed fragments and 2 microliths under construction are also attested. As regards the former, one of the backed points is represented by a typical Sauveterre point featuring a double convex back and two pointed ends and measuring 14 x 2 x 2 mm. More frequent are points with natural base. All the five items are proximal points manufactured by means of a long oblique truncation, in some cases with the microburin technique. Supports are tendentially laminar although their caliber is variable with length values spanning between 16 and 28 mm, width comprised between 5 and 14 mm and thickness between 1 and 3 mm. Scalene triangles are represented by 6 artefacts and were shaped out through direct retouch. The third side of triangles is always unmodified (Table 4.16) and in 4 of them a single (2) or double *piquant-trièdre* (2) is attested. From a dimensional point of view these triangles appear rather large and with a mean length/width ratio quite low (generally inferior to 2.5) (Table 4.17).

As regards layer 5a the total number of microliths is much higher (Table 4.15) and also their variability. Among the 17 backed points the most represented category is that with retouched base. Four of them feature a concave base - that is generally proximal - and a convex retouched lateral side. In two others the base is straight and

Table 4.15: Rouffignac, layers 5b and 5a. Microlithic armatures.

	L. 5b		L. 5a	
Backed points	6	33.3%	17	17.7%
Sauveterre	*1*		*2*	
natural base	*5*		*7*	
retouched base			*8*	
Crescents			1	1.0%
Scalene triangles	6	33.3%	29	30.2%
Isoscele triangles			14	14.6%
Scalene trapezes			1	1.0%
Backed fragments	4	22.2%	17	17.7%
backed fr.	*2*		*5*	
pointed backed fr.	*2*		*5*	
double backed fr.				
pointed double backed fr.			*1*	
backed-and-truncated fr.			*6*	
Under construction	2	11.1%	17	17.7%
Total	18	100%	96	100%

three of them present a partial complementary retouch. Dimensional values range between 17-22 mm in length and 5-8 in width and they are generally 2 mm thick (but for one thinner element). Two further backed points feature a convex retouched base associated to a backed side. Seven proximal backed points are characterized by a natural base opposed to an oblique retouch, as already seen in layer 5b. Finally the two Sauveterre-like backed points correspond to a double pointed and totally backed blank (16 x 4 x 1 mm) and an elongated backed point (20 x 3 x 2 mm). Triangles are represented both by scalene and isosceles types, the former being dominant. Triangles are less standardized than in the previous level (Table 4.17) and encompass both short and long morphologies. Scalene triangles featuring very short bases are not attested. The third side was not, generally, modified, although in 24.1% of scalene ones a simple complementary retouch is attested and only in 2 (6.9%) it was completely retouched. Only one isosceles triangle feature a partial complementary retouch. The two pointed ends are generally well manufactured by means of either direct or bipolar retouches but for 3 scalene triangles and 1 isosceles one in which the main point presents a residual portion of the butt. Moreover a crescent and a scalene trapeze are also attested. The latter is probably to be interpreted as an out-of-context artefact.

4.6.2 Retouched tools

For the production of retouched tools laminar blanks were preferentially selected along with flakes and, less frequently, different by-products and wastes (Table 4.18). In layer 5b 33.7% of retouched tools were manufactured on laminar by-products such as naturally backed blades and semi-cortical blades. Secondarily, blades, bladelets and flakes were selected. In layer 5a 40.5% of the blanks are represented by blade and bladelets, and 21.4% by laminar flakes. Initialization and maintenance blanks were only seldom retouched.

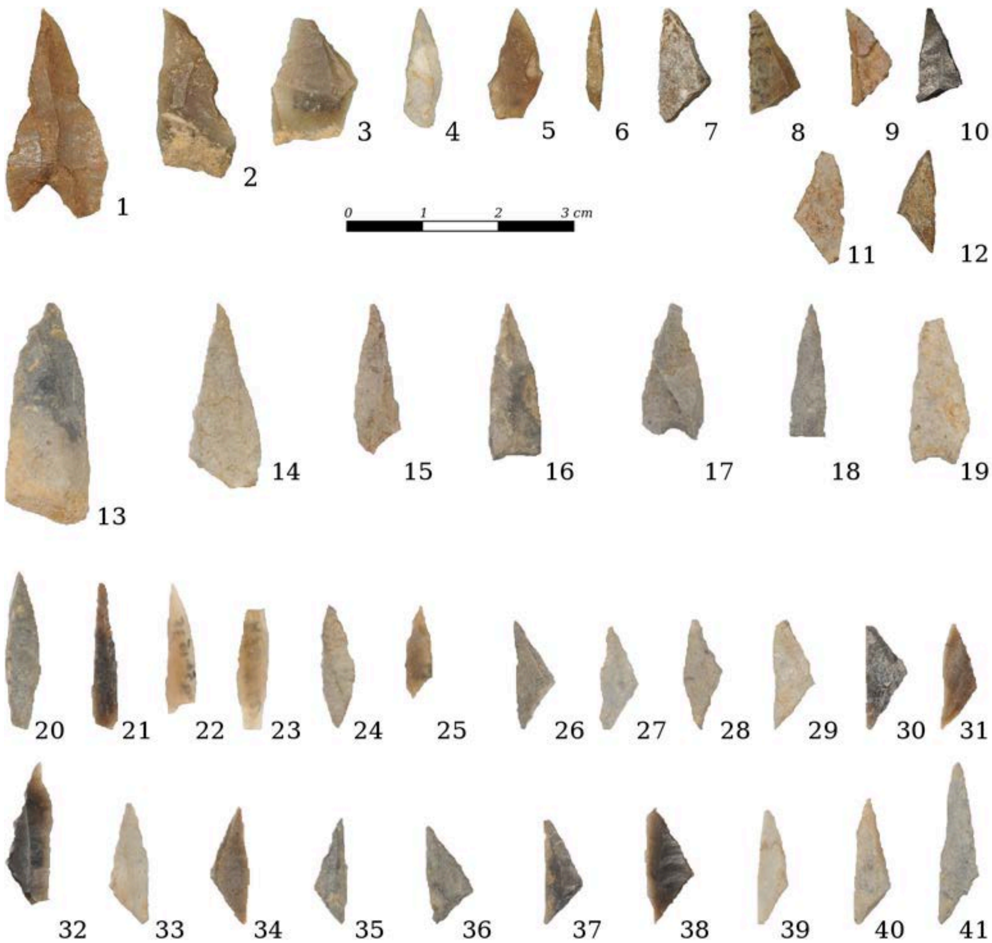

Figure 4.6: Rouffignac, L. 5b (1-12) and 5a (13-41). 1-5, backed points with natural base; 6, Sauveterre-like backed point; 7-12, triangles; 13-15, backed points with natural base; 17-19, backed points with retouched base; 20-25, Sauveterre-like backed points; 26-41, triangles.

Table 4.16: Rouffignac, layers 5b and 5a. Morphology of the third side of scalene triangles.

	L. 5b		L. 5a	
Backed third side			2	6.9%
Complementary retouch			7	24.1%
Natural third side	6	100.0%	20	69.0%
Total	6	100%	29	100%

Table 4.17: Rouffignac, layers 5b and 5a. Summary of dimensional values of triangles.

	L. 5b				L. 5a			
	L	W	T	L/W	L	W	T	L/W
Min.	12	5	1	1.50	11	3	1	2.00
1st Qu.	12.25	5.25	1	2.04	14	4	1	3.00
Median	13.5	6.5	1.5	2.29	16	5	2	3.40
Mean	13.83	6.33	1.67	2.25	15.88	4.93	1.74	3.37
3rd Qu.	14.75	7	2	2.56	17	5	2	3.75
Max.	17	8	3	2.80	21	7	3	4.75
σ	1.94	1.21	0.82	0.47	2.36	0.83	0.62	0.68
Count	6	6	6	6	33	43	43	33

From a typological point of view the two assemblages are composed of a wide set of tools, almost evenly represented (Table 4.19; Figure 4.7). In the oldest layer their number is much higher than in the other one. Burins are represented by 15 artefacts belonging to layer 5b and 5 to layer 5a. They were manufactured on very different kind of blanks, from blades and naturally backed blades to flakes and maintenance flakes. Number and location of burin spall removals are also varied. Simple and double types are attested in particular in layer 5b, while burins on fractures and truncations are present in both layers. In the older layer a multiple tool featuring 3 burins on the same blank is also attested. Endscrapers are only represented by three pieces collected in layer 5b. They are all short types, one is characterized by a broad front and lateral retouches while the other two are an ogival endscraper and a nosed one. Truncations represent around 15% of retouched tools. Straight truncations are more abundant in both layers and were realized on laminar and flake products and by-products. In some cases the truncation is only roughly shaped out with few, or even single, large removals and assumes a concave profile. Oblique truncations were preferentially manufactured on the distal end of laminar blanks such as blades/bladelets and laminar flakes. In one case a naturally backed blade was selected and modified with a bidirectional oblique retouch, in continuity with the natural side thus obtaining a sort of backed and truncated knife.

The assemblage of backed knives is rich and conspicuous and it was, in fact, one of the aspects concerning the lithic assemblage of the site that was highlighted the most in the two previous studies (Barrière, 1972; Rozoy, 1978). Barrière, in particular, identified a specific morphotype that was initially named *couteaux-faucille* and was later known as Rouffignac backed knife. The name is related to the presence of a bright polish on three of the specimens belonging to layer 5b, one from layer 5a and one from layer 4.

Table 4.18: Rouffignac, layers 5b and 5a. Blanks selected for the production of retouched tools.

	L. 5b		L. 5a	
Blades/bladelets	18	20.9%	17	40.5%
Laminar flake	8	9.3%	9	21.4%
Blades/flakes	1	1.2%	1	2.4%
Flakes	12	14.0%	6	14.3%
Laminar by-products	29	33.7%	4	9.5%
Flake by-products	11	12.8%	3	7.1%
Initialization	2	2.3%		
Maintenance blades	2	2.3%	2	4.8%
Maintenance flakes	2	2.3%		
Different	1	1.2%		
Total	86	100%	42	100%

Barrière defined these tools as "more or less large blades with thick butts (Rouffignac technique), featuring a backed side, an oblique truncation and two opposed basal notches, often alterne". The revision of the backed knives assemblage confirmed the presence of this specific morphotype although the number of artefacts attributed to this category was drastically reduced from 19 (Barrière, 1972) to 6 (see Visentin et al. in press for details) (Figure 4.8). Originally Rouffignac backed knives were probably 7, as one of the pieces drawn and published by Barrière was not included in the studied assemblage (along with what seems like a naturally backed blade and another fragment). From a techno-typological and morpho-functional viewpoint the features that are consistent with the definition of this particular tool-type are: a long and fine cutting edge (35-40°), two bilateral basal notches (direct, indirect or alternating), a backed distal oblique truncation and a straight backed side. The two latter elements can be substituted by a convex backed side. It is likely that the presence of the two basal notches is consistent with a particular hafting modality of these backed knives although the absence of proper hafting traces did not allow to shed any light on this matter. For the manufacture of backed knives both blades, semi-cortical blades and cortical backed blades were used. The length of finished tools vary from 50 to 106 mm. The 6 Rouffignac backed knives, all belong to layer 5b. The others are mostly represented by curved backed knives with a total retouch. In some cases retouch is only partial or is located in continuity with the naturally backed or hinged edges of the blanks, thus allowing an opportunistic exploitation of their natural morphology. One tool stands out with respect to the others as it was manufactured on a thick naturally backed blade and does not feature a cutting edge but a denticulated one.

Borers are attested only by three pieces belonging to layer 5a. Blanks are represented by a blade and two flakes. These artefacts were not carefully shaped out and blank natural morphology was only partially modified by retouch. Three other flakes and blades as well as numerous fragments feature abrupt retouches. A good number of fragments can hypothetically be interpreted as backed knives portions although their incompleteness does not allow a definitive attribution.

Among pieces featuring semi-abrupt retouches, pointed ones are almost absent and only testified by a neo-crested blade with an inverse simple and marginal distal retouch. More frequently laminar and flake products and by-products were laterally modified. Retouch is more frequently inverse and can either be marginal or deeper. Only one flake was transversally retouched along the distal end of the blank.

The category of denticulates includes tools manufactured on different types of blank. Blades and flakes were selected along with semi-cortical and naturally backed artefacts and a naturally crested blade. At a general level selected blanks are quite thick with values spanning between 5 and 30 mm. Retouch is mostly direct and involves one or more edges of the blanks, both lateral and transversal. In one case the bilateral denticulated retouch forms a distal point. Notched blades and flakes are less frequent than denticulated pieces. In most cases cases a single notch was created by direct retouch on either the lateral or the distal edge. The only artefacts attesting multiple notches is a semi-cortical flake belonging to layer 5b (3 notches). Mixed composite tools are represented by two artefacts opposing a pointed end to, respectively, a simple burin and a double burin (one lateral removal and one transversal). The former was manufactured on a partially crested blade while the latter on a burin spall. On a semi-cortical flake a burin on break is associated to a lateral marginal semi-abrupt retouch. The last artefact, the only one belonging to layer 5a, is a laminar flake with a rough concave distal truncation and a lateral notch.

Table 4.19: Rouffignac, layers 5b and 5a. Retouched tools.

	L. 5b		L. 5a	
Burins	15	17.4%	5	11.9%
Endscrapers	3	3.5%		
Truncations	14	16.3%	6	14.3%
Backed knives	13	15.1%	3	7.1%
Borers			3	7.1%
Backed pieces	3	3.5%	1	2.4%
Backed fr.	5	5.8%	6	14.3%
Pointed pieces	1	1.2%		
Retouched pieces	15	17.4%	8	19.0%
Retouched fr.	2	2.3%		
Denticulates	10	11.6%	6	14.3%
Notched pieces	2	2.3%	3	7.1%
Composite tools	3	3.5%	1	2.4%
Total	86	100%	42	100%

4.7 Use and wear

A preliminary analysis conducted on around 200 unretouched bladelets and flakes belonging to layer 5b revealed a pretty poor preservation state of the lithic assemblage that is the result of concurring factors. The current state of edges and surfaces is probably the result of chemical and mechanical taphonomic processes originated by the depositional environment and by excavation and post-excavation procedures. Artefacts, in particular, are characterized by an intense, although not invasive, micro-scarring that in numerous cases completely destroyed the edges of the blanks. Moreover, high magnification observations revealed the presence of numerous abraded areas and bright spots, while ridges do not appear to be rounded. Most likely these features

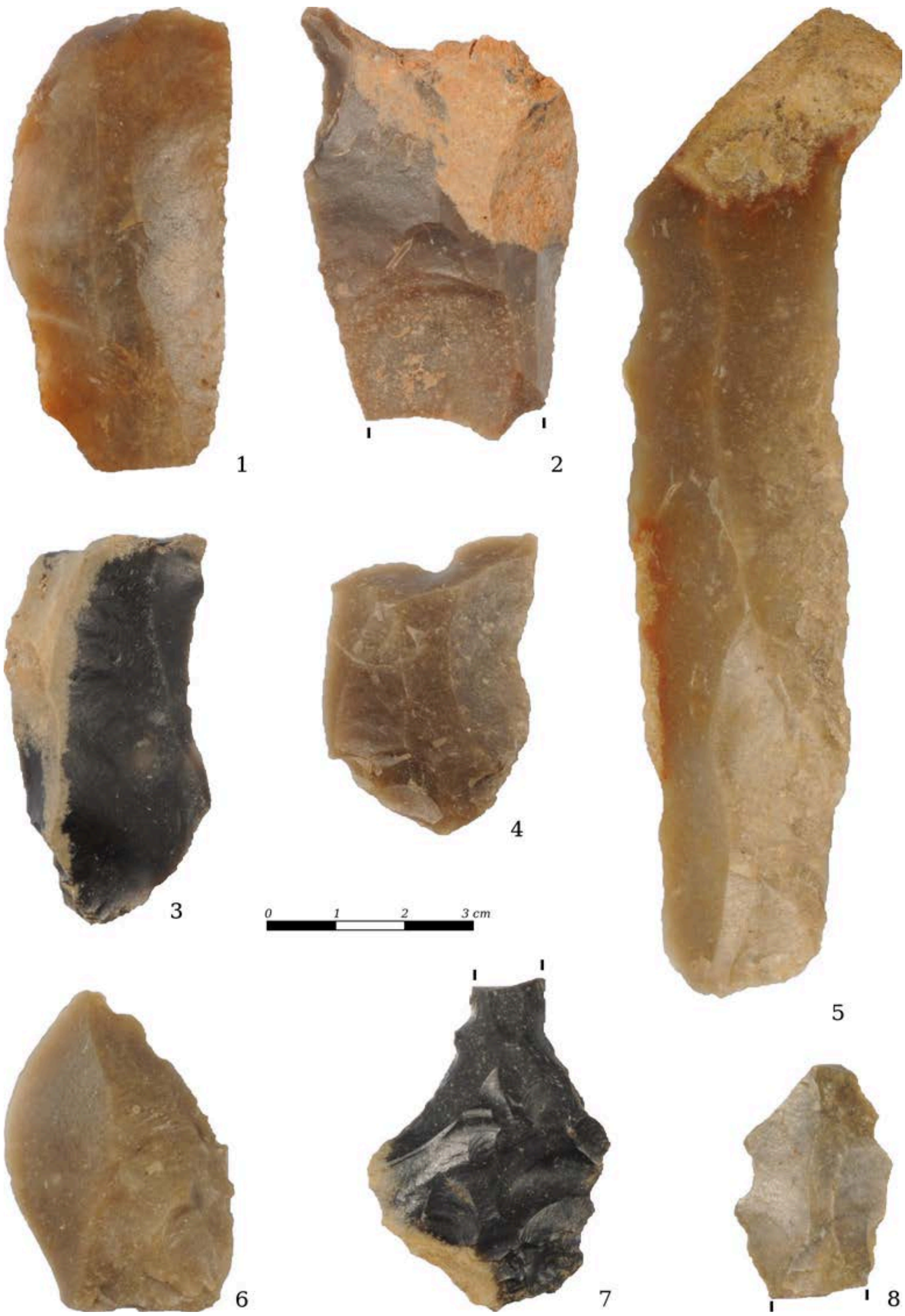

Figure 4.7: Rouffignac, L. 5a. 1, backed knife; 2, borer; 3-4, truncated pieces; 5, retouched blade; 6-8, denticulated pieces.

Figure 4.8: Rouffignac, L. 5b. 1-6, Rouffignac backed knives; 7-12, artefacts described as Rouffignac backed knives in previous pubblications (7-9, "regualar" backed knives; 10, denticulated blade, 11-12, retouched blade/laminar flake) (after Visentin et al., in press).

are the result of small scale movements and frictions that the archaeological material underwent during and after the excavation. Lithic artefacts, in fact, were stored in large wooden boxes without being separated into small bags but for most armatures and retouched tools. In addition the chemistry of the clayish sediment that characterize the sedimentary context of the cave induced the formation of a well developed soil sheen. As a result, it is likely that most use-wear traces were destroyed by these processes.

In light of these considerations the results of traceological analysis are to be considered as incomplete and partially biased. Anyways interesting results could be obtained for a specific tool type - backed knives - and the cinematic with which a small assemblage of artefacts was used could be reconstructed. In both layers all retouched artefacts (both tools and microliths) were analyzed. Moreover a selection of 40 unretouched blanks belonging to layer 5b and 36 belonging to layer 5a was analyzed. The latter had already been separated from the rest of the lithic material during the previous studies and were, thus, considered to be possibly better preserved.

4.7.1 Unretouched and retouched tools

As regards layer 5b only 20 retouched and unretouched tools yielded use-wear traces (6) or possible use-wear traces (14).

Longitudinal actions are attested on 6 unmodified blanks, 2 oblique truncations and 2 backed knives (one of which is a Rouffignac backed knife). Four of these artefacts were used for the same activity: cutting reeds. On the Rouffignac backed knife, the regular backed knife and the cortical backed blade the presence of a bright polish along one of the edges had already been identified by Barrière (1972). On the base of ethnographic and experimental comparisons he interpreted this polish as being the result of wild *Graminaceae* harvesting. According to Rozoy (1978) such a polish could not be due to the processing of vegetal materials as, by comparison with experimental and archaeological references, it should have been much more invasive than it actually was. Consequently he proposed that it was due to cutting a thin material, probably leather lying on a wooden support. In light of the presence of this polish on the holotype of Rouffignac backed knives as well as on other retouched and unretouched blanks, the latter were included in the typological class of the former, leading to an overrepresentation of the sample and to a difficult definition as almost every cutting tool could have fitted the category (Visentin et al., in press). The early identification of these tools probably favoured their better preservation with respect to the rest of the assemblage. A preliminary analysis of a sample of laminar blanks carried out by Guilbault (2011) led to the identification of another artefact (the fourth one) belonging to layer 5b - a truncated blade - attesting similar use-wear traces. On the 4 artefacts a single active zone corresponding to the lateral cutting edge was identified (Figures 4.9 and 4.10). A well developed and defined bright polish is associated to scalar semicircular oblique removals with a hinged termination that are irregularly spaced and present on both aspects (Visentin et al., in press). The edge is well rounded and symmetrical, although the presence of almost continuous taphonomic edge-damage does not allow to fully appreciate it. The polish is characterized by a highly reflective aspect and appears matt and smooth in texture, with a domed topography. Striations are frequent and parallel to the edge. The polish is more invasive than the edge scarring reaching 2 mm and its limits are well defined towards the inner parts of the tools, more degressive in the two extremities. The association of polish and edge scarring is testified by the partial covering of the removals. These characteristics are consistent with the working of resistant, siliceous-rich plants such as reeds. The distribution and directionality of polish, striations and removals indicate a longitudinal activity. The asymmetric distribution of the polish on the scars, moreover, suggests a preferential unidirectional movement. The inferred motion is thus a cutting activity that could be interpreted as the harvesting of reeds. The comparison with experimental references at different degrees of polish development indicates that such activity had been performed over several hours, in particular for the Rouffignac backed knife and the cortical backed blade. Use-wear and, in particular, polishes on the oblique truncation - the one that was not identified by Barrière - are quite degraded and partially destroyed by wide abraded surfaces, in particular in the mid portion.

The remaining 5 unretouched blanks that yielded possible longitudinal use-wear traces are represented by one blade, 2 semi-cortical blades, 1 naturally backed blade and 1 cortical backed blade. Their length is comprised between 42 and 95 mm. Due to the poor preservation state it was not possible to determine the worked material. In three cases it is likely that it was a soft material. Additionally an oblique truncation yielded use-wear traces connected to the cutting of an undetermined material.

The semi-abrupt retouched pointed end of a composite tool was used for perforating, with an unidirectional movement a mid-hard material as demonstrated by some burinant removals on the tip. Three burins were used for scraping a mid-hard material in correspondence of one lateral dihedral formed by the negative of the burin spall. As regards retouched, notched and denticulated pieces in 4 cases used zones do not correspond with the modified part of the blank but with the edge opposite to it. It could be surmised that such retouches, often marginal and not very regular in term of intensity and delineation, are functional to the prehension of the tools. In three cases the presence of perpendicular trapezoidal or semicircular, deep, step or hinged terminating removals indicates that the worked material was probably a hard or mid-hard one and the action transversal. A tool in which 3 notches had been manufactured was probably used with a similar cinematic. In this case use-wear is attested on 2 of the 3 retouched edges. A possible transversal action carried out with a simply retouched edge was identified also on the last tool, although the hardness of the worked material could not be reliably inferred.

Table 4.20: Rouffignac, layers 5b and 5a. Unmodified blanks featuring use-wear traces.

	L. 5b		L. 5a	
Blades/bladelets	1	16.7%	4	40.0%
Naturally backed blades/bladelets	1	16.7%	1	10.0%
Cortical backed blades/bladelets	2	33.3%	1	10.0%
Semi-cortical blades/bladelets	2	33.3%	2	20.0%
Cortical backed flakes			1	10.0%
Surface maintenance blade			1	10.0%
Total	6	100%	10	100%

As regards layer 5a, 27 artefacts yielded use-wear traces, 17 of which are retouched tools (Figure 4.11; 4.12) and 10 unmodified ones(Figure 4.13). The latter are mostly represented by laminar products and by-products, along with 2 flakes (Table 4.20). One of them, a cortical naturally backed blade, had been used to cut a mid-hard material as testified by the presence of deep, semicircular or trapezoidal, hinge or step terminating, bifacial removals. The others were all used to carry out unidirectional

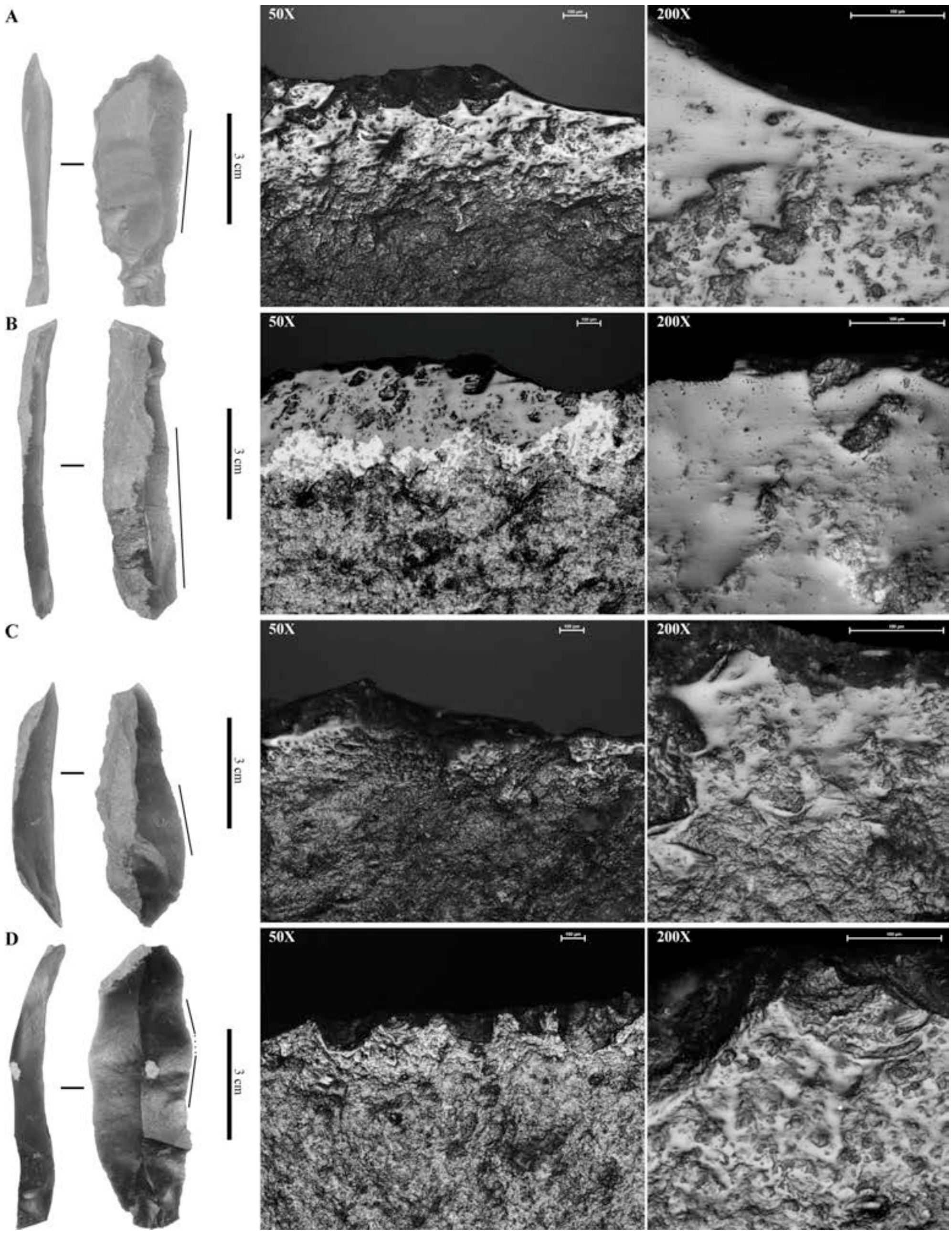

Figure 4.9: Rouffignac, L. 5b. Artefacts used for cutting reeds. A, Rouffignac backed knife; B, naturally backed blade; C, backed knife; D, truncated blade (after Visentin et al., in press).

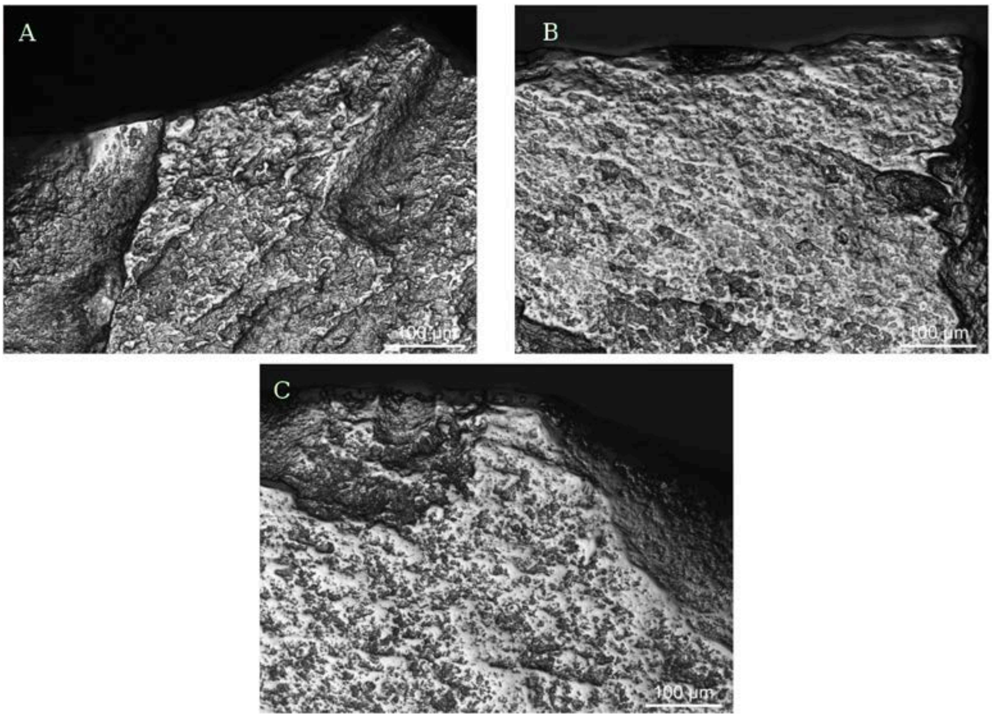

Figure 4.10: Polishes developed on the edge of experimental blades used for working reeds (Phragmites australis): A. cutting dry reeds, 25 minutes; B. cutting fresh reeds, 30 minutes; C. cutting fresh reeds, 55 minutes. All photos were taken at 200X. Artefacts belong to the experimental reference collection of Leiden University (after Visentin et al., in press).

transversal actions. A semi-cortical blade and a cortical backed flake were used for scraping a hard material. The former actually attest 2 active zones on the same edge with contact and leading surfaces inversed. Two bladelets and a semi-cortical bladelet (length between 42 and 53 mm) were used for scraping a mid/mid-hard material. In one case both lateral edges were used with a similar motion. The distal fragment of a larger blade (26 mm wide and 10 mm thick) was used for scraping an abrasive material. The active zone is limited to the edge portion next to the fracture (already present at the time of the utilization). In the other three cases it was not possible to determine the worked material.

Table 4.21: Rouffignac, layers 5b and 5a. Retouched tools featuring use-wear traces. Percentage refers to the category totals.

	L. 5b		L. 5a	
Burins	3	3.5%	1	2.5%
Truncations	2	2.3%		
Borers			3	7.5%
Backed knives	2	2.3%	3	7.5%
Backed fr.			1	2.5%
Retouched pieces	3	3.5%	7	17.5%
Denticulates	1	1.2%	2	5.0%
Notched pieces	2	2.3%		
Composite tools	1	1.2%		
Total	14	16.3%	17	42.5%

As regards modified tools, most of retouched and backed pieces yielded use-wear traces in correspondence of unmodified edges, generally located opposite from modified ones. Two backed knives and one partially retouched blade attest a longitudinal motion. The larger backed knife is characterised by the presence of a well developed polish referable to the cutting of reeds, as seen in layer 5b. On the distal part of the active edge a series of flat, direct retouches is attested. Such removals are partially covered by the polish, thus, suggesting their anteriority and can be interpreted as a partial resharpening of the blade. On the two other pieces, worked material is a soft or mid-soft one as attested by small, spaced, bifacial removals. The remaining backed knife and the backed fragment along with 4 retouched pieces (2 blades/bladelets, 1 laminar flake and 1 semi-cortical flake) and 1 denticulated flake worked mid-hard or hard materials. The scraping of a mid-hard material is attested also by 3 active zones present on a blade that was transformed into a burin on break. The fracture and the facet of the burin spall cut two of these used edges. No evidence of use is attested after the blank was modified into a burin. On two retouched pieces used edge was the retouched one and in both cases it is represented by an indirect, continuous retouch. Worked material is supposed to have been a mid-hard one. On the remaining denticulated piece, 2 active zones were identified: one correspond to a possible longitudinal action attested on a natural edge, the other to the tip created by two adjacent notches that was used with a transversal motion. Additionally three borers yielded use-wear traces (2) or possible use-wear traces (1) on their tips. In one case worked material is supposed to have been a relatively soft one, in the two others it is undeterminable.

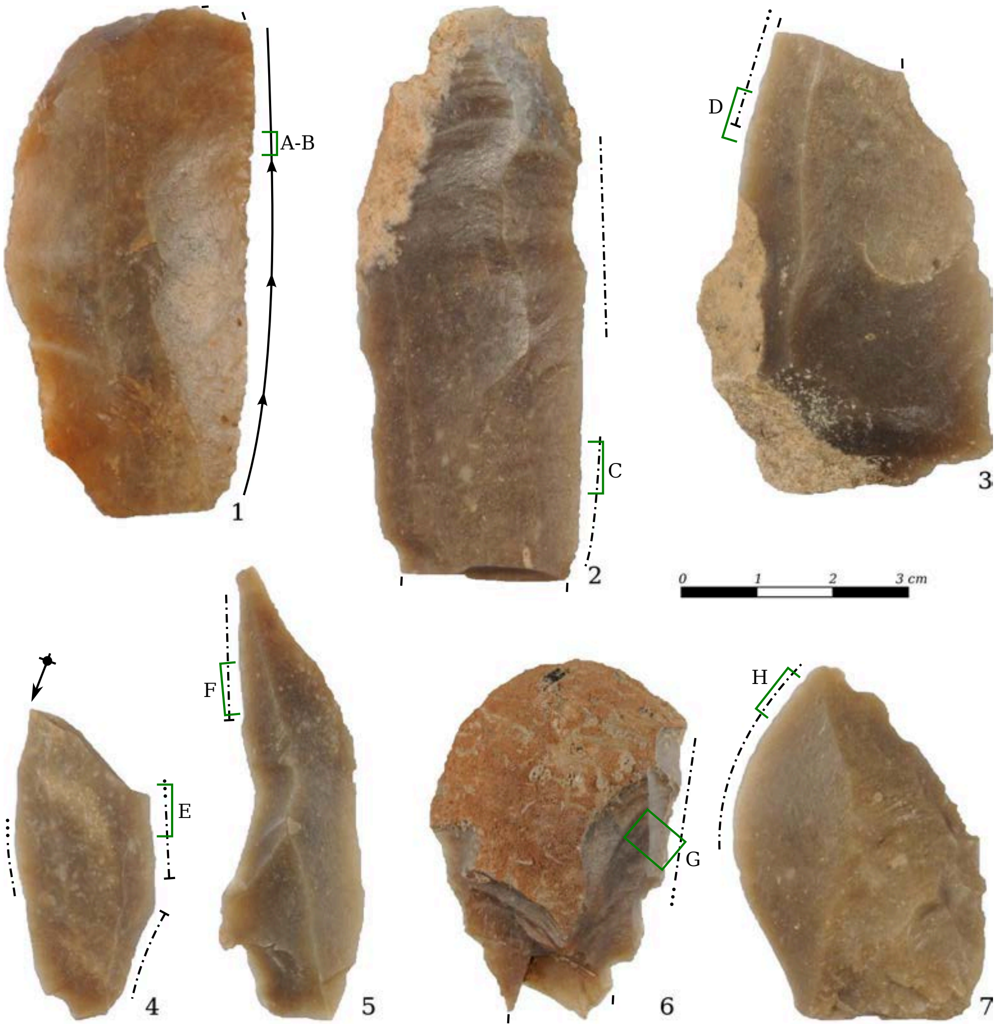

Figure 4.11: Rouffignac, layer 5a. Retouched tools featuring use-wear traces: 1, backed knife; 2-3, retouched pieces; 4, burin; 5, backed piece; 6-7, denticulated pieces. Micro-wear is reported in Figure 4.12

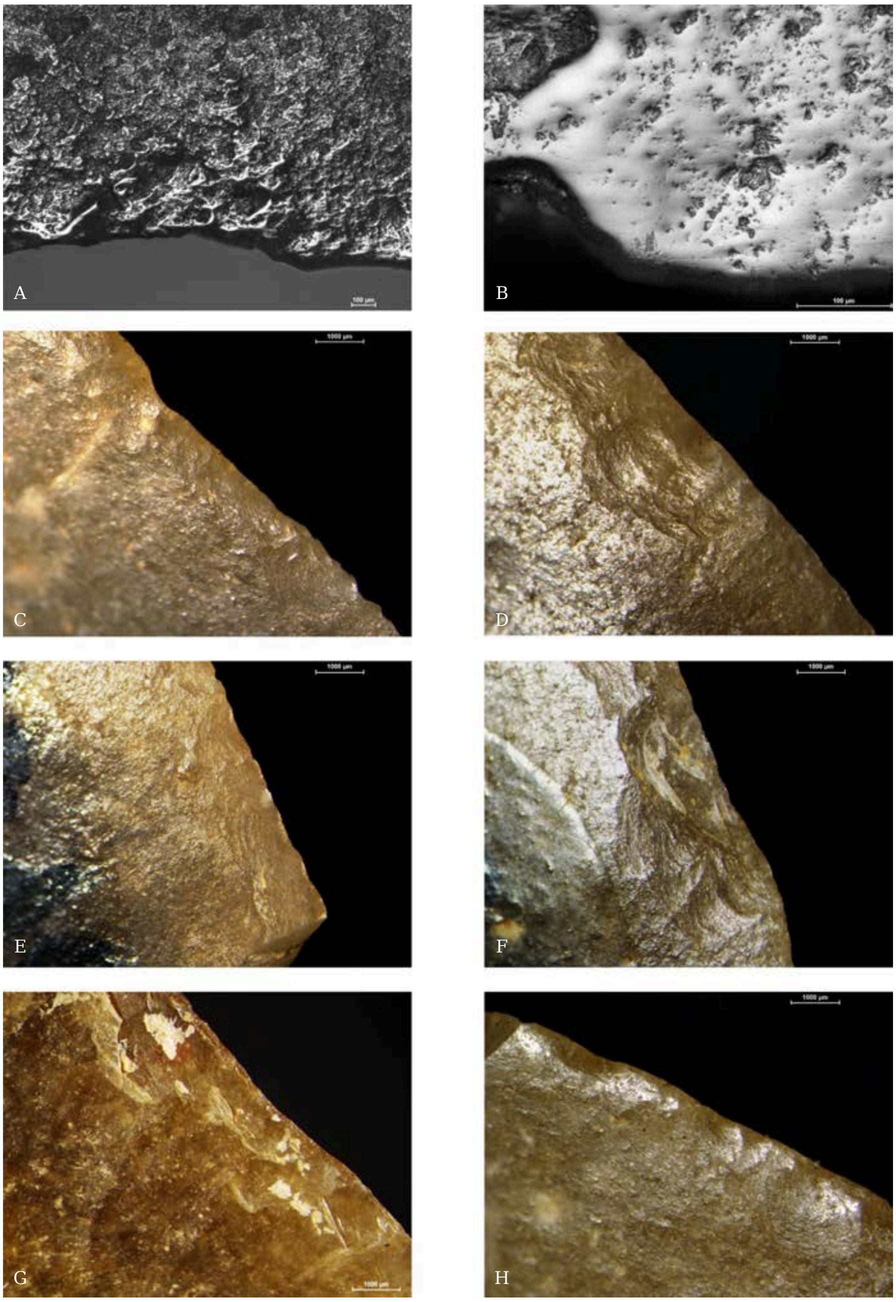

Figure 4.12: Rouffignac, layer 5a. Use wear traces identified on the artefacts included in Figure 4.11. A-B, well developed bright and domed polish referable to the cutting of reeds; C-E, H, thin and regular, semicircular, feather or slightly hinge terminating bending removals connected to the scraping of a mid-soft/mid-hard material (figure E shows that use-wear precedes the fracture from which the burin spall was detached); F-G, semicircular and trapezoidal step terminating, stepped removals interpretable as due to the working of a hard material (photo A taken at 50X, B at 200X, C-H at 10X).

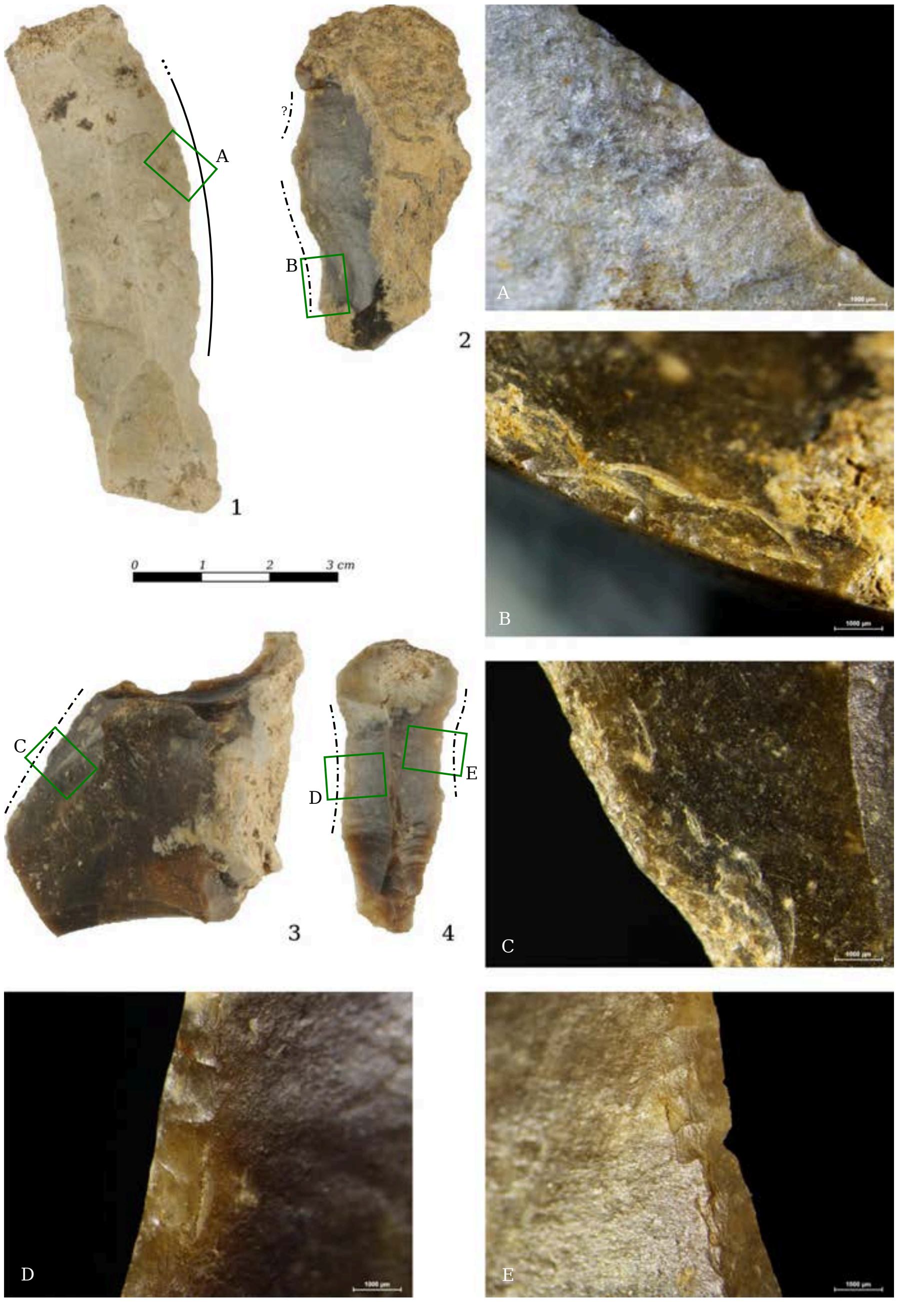

Figure 4.13: Rouffignac, layer 5a. Unretouched tools featuring use-wear traces: 1, naturally backed blade used for sawing a mid-hard material (A); 2-3, flake by-products used for scraping hard materials as suggested by the unidirectional stepped hinge or step terminating bending removals (B-C); 4, bladelet used for scraping a mid-hardness material (wood?) on both edges, as indicated by the regular, semi-circular or quadrangular slightly hinge terminating bending removals (photos taken at 10X). On figure E two post-depositional removals are well highlighted by the "V" shaped profiles.

4.7.2 Microlithic armatures

Table 4.22: Rouffignac, layers 5b and 5a. Number of artefacts that yielded impact traces and percentage with respect to category totals. Between brackets the number of artefacts with possible traces.

	L. 5b		L. 5a	
	u-w/tot.	%	u-w/tot.	%
Sauveterre backed points	0/1	-	1(1)/2	50.0%
Backed points with natural base	0/5	-	4(3)/7	57.1%
Backed points with retouched base	-	-	5(2)/8	62.5%
Scalene triangles	3/6	50.0%	5(2)/29	17.2%
Isoscele triangles	-	-	2/14	14.3%
Backed fragments	1(1)/4	25.0%	2(1)/17	11.8%
Total	4/18	22.2%	19/96	19.8%

Among microlithic armatures 23 artefacts yielded macroscopic impact fractures (13) and possible impact fractures (10). 19 of these artefacts belong to layer 5a while only 4 to layer 5b (Table 4.22).

On backed points with retouched base (5) impact traces are mostly localized in correspondence of their tips where bending fractures with *languettes* (2) and burinations (3) were identified. In two cases these are associated to basal fractures: a long hinged burination and a snap fracture. Points with natural base attest a similar pattern. On their main tips, 2 feather-terminating burinations, 1 bending fracture with *languette* and one complex fracture featuring a 2 mm long burinant spin-off were identified. Impact related damage of the bases is possibly attested by the presence of micro-scarring on one of them. One Sauveterre backed point yielded possible use-wear traces represented by the association of an apical bending fracture with a short step-terminating *languette* and a basal snap fracture. As regards triangles there seem not to be any differences neither between scalene and isosceles forms nor between the two layers as far as use-wear is concerned. 9 of them feature at least one feather- or step-terminating burination (0.7 to 5.9 mm long) on one of the two points. In one case multiple removals are attested. 2 triangles feature a second fracture on the other point, one of which is a burination, the other a composite fracture with a burinant spin-off. In the last triangle a bending fracture with a short languette is attested on one of the two points. In addition, along the natural third side of 5 triangles few, generally small, semicircular or oblique removals are located.

The high presence of impact-related damages on both points with natural and retouched base, as well as their preferential distribution on the main point of these microliths suggest an axial hafting modalities. In the case of points with retouched base it is possible that one of the two secondary points also played a retentive role (latero-axial arrangement), but the lack of evidence does not allow to discern between the two modalities. On the other hand a lateral hafting can be surmised for triangles and crescents.

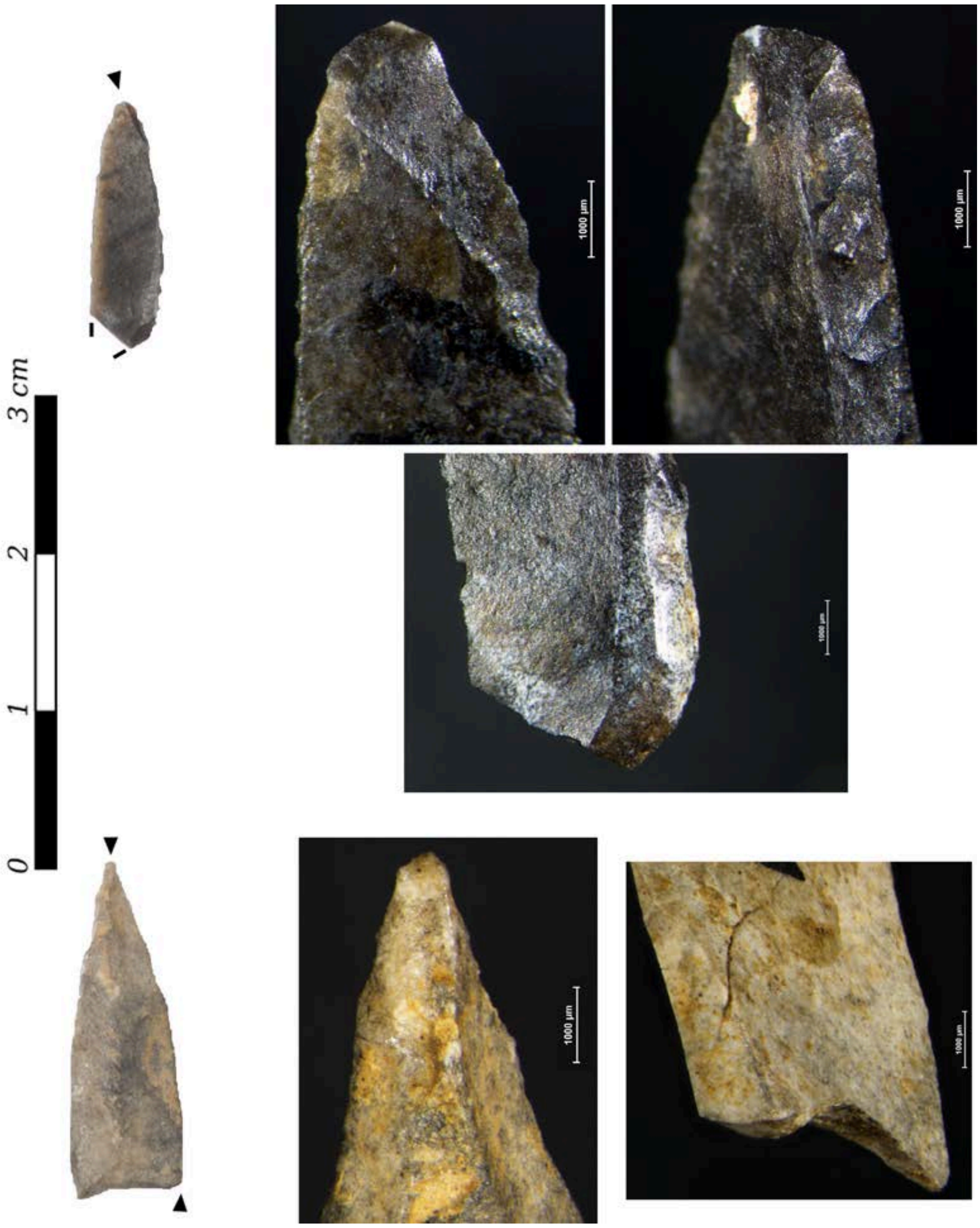

Figure 4.14: Rouffignac, L. 5a. Microliths with impact fractures. Scalene triangle (above) with a double impact fracture on its apex and particular of a patchy white patina, possibly corresponding to the hafting area; backed point with retouched base featuring a long bending fracture on the apex and a burination on the base.

Chapter 5

Fontfaurès

Contents

5.1 Site introduction

The site of Fontafaurès (Figure 5.1) is located along the western limit of the Causse de Gramat, one of the limestone plateaus bordering north-west to south-east the Massif Central. The small rockshelter where the site was identified, is placed at 215 m a.s.l., at the bottom of a narrow valley excavated by the stream Signe, a tributary of the river Célé, in turn a tributary of the river Lot (Barbaza et al., 1991). The north-west facing rockshelter is about 12 x 5 metres wide. It was initially identified by Jean-Claude Faurie, that at the time was in charge of Pech Merle cave. He, accidentally, identified some chert flakes along with a Sauveterre point in the sediment reworked by a fossorial animal. After a clandestine trench was dug in the inner part of the sheltered area and in light of its proximity to a departmental road it was decided to carry out an excavation that took place between 1985 and 1987 under the direction of Michel Barbaza.

The stratigraphic sequence is composed of 7 main sedimentary layers (Barbaza et al., 1991). The lower one (L. 7), characterized by orange clayish sediments including angular clasts, yielded very few artefacts, mostly located in its uppermost portion. Layer 6, characterized by smaller clasts (1-2 cm), was subdivided into three levels, 6c, 6b and 6a, of respectively 10, 5 and 5 to 10 cm. Level 6b included numerous well preserved charcoal fragments. These levels have been considered as a single one during previous studies. Layer 5, with a total thickness of about 35 cm, was subdivided into 4 sublevels, 5d-a. Clasts are generally small-sized (smaller than 5 cm)

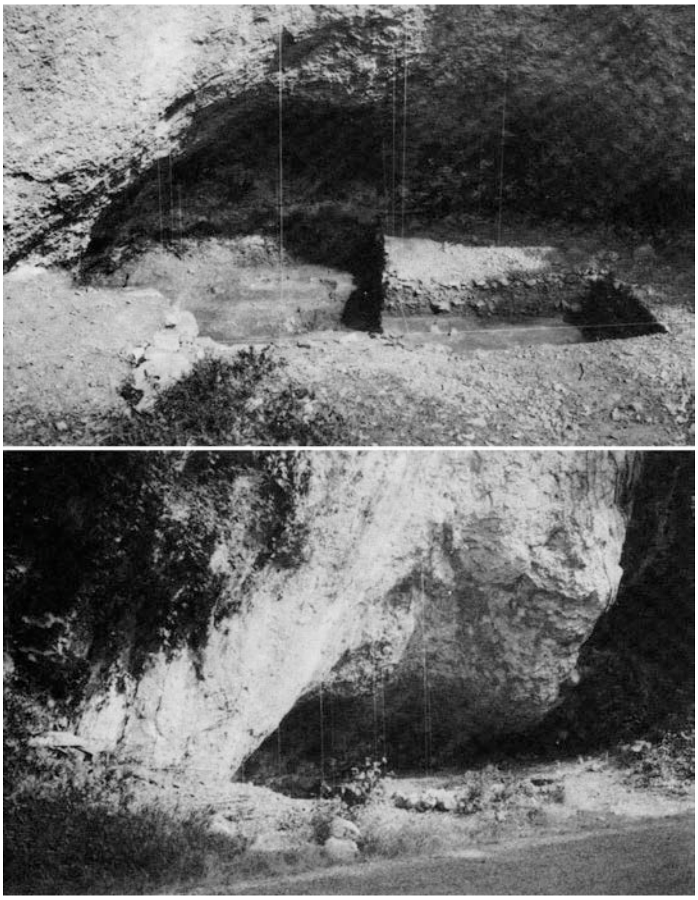

Figure 5.1: Fontfaurès. Panoramic view of the rockshelter and the excavated area (after Barbaza et al., 1991).

and the matrix is fine and powdery. Sublayer 5d included a hearth as did sublayer 5b. The latter level was characterized by a grayish and compact sediment. Layer 4 was subdivided in two horizons on the base of the presence (in the uppermost) and absence (in the lowermost) of potsherds. From a sedimentological viewpoint no difference between the two could be highlighted. Layer 4a was thus interpreted as a reworked level connected to the late prehistoric settlement of the rockshelter. The uppermost levels (3-1), in fact, yielded artefacts and structures dated between the Late Neolithic and Historic periods.

Two radiocarbon datings are available (Table 5.1), placing respectively the older layer in the mid-Preboreal and the other one either at end of this chronozone or at the beginning or the Boreal.

The analysis of faunal remains indicates that forest species such as red deer (48%), wild boar (18%) and roe deer (13%) dominate the entire series (Barbaza et al. 1991). Moreover, in the oldest layers (6c-a), beaver is also attested. Five fish vertebrae were identified in layers 6 to 5. Four of them were attributed to cyprinids (most likely *Leuciscus leuciscus* and *Leuciscus cephalus*), the other one to *Salmo salar*. The analysis of malacofauna remains, substantially, confirmed the palaeontological data. In particular

Table 5.1: Fontfaurès. Available radiocarbon dates.

Layer	Lab. ID	Material	Radiocarbon age	Calib. age BP (2σ)
L. 5b	Ly. 4448	Hazelnut	9140 ± 160	10,740-9780
L. 6b	Ly. 4449	Charcoal	9650 ± 130	11,270-10,645 (93.9%) 10,632-10,589 (1.5%)

it was possible to distinguish 3 phases. Two of them correspond to the Preboreal and attest the change from a colder stage, characterized by open forests to a more humid one with a denser afforestation. Layer 4b, on the other hand, seems to reflect a more mediterranean climate.

The analysis of the lithic assemblages allowed attributing the levels to different evolutionary phases of the Sauveterrian: layer 6 was attributed to the early Sauveterrian, layers 5d-5a to an evoluted early Sauveterrian and layers 5a-3 to an ancient phase of the middle Sauveterrian or Montclusian (Barbaza and Valdeyron, 1991; Valdeyron et al., 2008). Diachronically, the most relevant trend that was identified is that related to the evolution of the morphology of triangular microliths (Barbaza and Valdeyron, 1991; Valdeyron, 1994; Valdeyron et al., 2008). In particular the most ancient phases are characterized by isosceles and regular scalene triangles. The former disappear in the most recent layers while the latter gradually become more elongated and start to be characterized by the presence of a retouched third side (*Triangle de Montclus*).

5.2 Lithic assemblages

Three of the above presented layers were selected for the analysis, one for each identified phase: layer 6, 5b and 4b. These are respectively composed of 1184, 1624 and 1192 artefacts (Table 5.2).

Table 5.2: Fontfaurès, l. 6, 5b, 4a. Composition of the studied lithic assemblages.

	L. 6		L. 5b		L. 4b	
Cortical and semi-cortical blanks	100	8.4%	150	9.2%	116	9.7%
Laminar blanks	229	19.3%	226	13.9%	212	17.8%
Flake blanks	111	9.4%	214	13.2%	103	8.6%
Maintenance blanks	45	3.8%	35	2.2%	24	2.0%
Burin spalls	7	0.6%	1	0.1%		0.0%
Undetermined fr.	405	34.2%	644	39.7%	513	43.0%
Flakes < 1 cm	176	14.9%	241	14.8%	164	13.8%
Retouched blanks	70	5.9%	100	6.2%	51	4.3%
Transformation wastes	31	2.6%	4	0.2%	2	0.2%
Cores	10	0.8%	9	0.6%	7	0.6%
Total	1184	100%	1624	100%	1192	100%

In the earliest level the number of burnt artefacts is attested around 42% while in the latter two it is higher than 65% (Table 5.3). Similarly the number of undetermined fragments is lower in the former, although in this case differences are more gradual. As regards the integrity of the artefacts entered into the database percentages between the three classes do not vary significantly along the sequence (Table 5.4). Entire pieces represent roughly 30% of the assemblages while the percentage of fragments is included between 41 and 50%.

Table 5.3: Fontfaurès, l. 6, 5b, 4a. Thermal alteration of the artefacts.

	L. 6		L. 5b		L. 4b	
Unaltered	680	57.4%	553	34.1%	394	33.1%
Altered	504	42.6%	1071	65.9%	798	66.9%
Total	1184	100%	1624	100%	1192	100%

Table 5.4: Fontfaurès, l. 6, 5b, 4a. Integrity of the artefacts entered into the database

	L. 6		L. 5b		L. 4b	
Entire	206	31.6%	243	32.6%	158	28.3%
Incomplete	158	24.3%	194	26.0%	124	22.2%
Fragments	287	44.1%	308	41.3%	276	49.5%
Total	651	100%	745	100%	558	100%

All the artefacts have been analysed from a techno-typological point of view. Functional analysis was not carried out due to time constraints and considering that an extensive sample had already been analysed by S. Philibert (2002). The main results of her work will be reported instead.

5-3 Raw material provisioning

As already pointed out by a previous study (Briois, 1991), the most consistent group of exploited raw materials is represented by Upper Cretaceous and Tertiary cherts outcropping in the Massif Central area (Table 5.5). These were mostly collected from soil and alluvial deposits, such as the Lot and Célé riverbeds, as testified by their well rounded cortical surfaces (Table 5.6). The river Lot lies 6 kilometres to the south of the site. The quality of these raw materials is variable and both fine and coarse lithotypes are attested. Along the sequence, a difference in provisioning strategies can be appreciated. In the lowermost layer, in fact, the percentage of artefacts collected from gravelly alluvial deposits and soils is similar. In the two other layers the former becomes gradually dominant while the latter decreases. The size of collected pebbles probably was not homogenous, spanning from few centimetres to around 10. In similar alluvial contexts some pebbles of quartz and yellow-reddish jurassic cherts and radiolarites were also probably collected.

Another group of raw materials was procured at longer distances, around 50 km to the west of the site, following the river Lot towards the Atlantic ocean. It is represented by a very good quality grayish chert of Turonian age (Upper Cretaceous) known as "Fumelois". Also in this case cobbles were collected. The products realized with this raw material are characterized by a highly laminar and regular aspect with respect to other raw materials. No cores are attested.

Table 5.5: Fontfaurès, l. 6, 5b, 4a. Exploited cherts, divided according to their age.

	L. 6		L. 5b		L. 4b	
Tertiary	315	47.7%	277	36.7%	186	32.9%
Upper Cretaceous	149	22.5%	55	7.3%	22	3.9%
Turonian (Fumelois)	37	5.6%	2	0.3%	1	0.2%
Jurassic	16	2.4%	6	0.8%	8	1.4%
Quartz	1	0.2%	4	0.5%	13	2.3%
Undetermined	143	21.6%	410	54.4%	335	59.3%
Total	661	100%	754	100%	565	100%

Table 5.6: Fontfaurès, l. 6, 5b, 4a. Provenance context of exploited raw material derived by the analysis of residual cortical surfaces.

	L. 6		L. 5b		L. 4b	
Outcrop or proximity					2	1.4%
Slope deposit	2	1.4%	6	3.1%	2	1.4%
Alluvial cobble	37	26.4%	103	53.9%	94	64.8%
Soil	39	27.9%	28	14.7%	13	9.0%
Undetermined	62	44.3%	54	28.3%	34	23.4%
Total	140	100%	191	100%	145	100%

5.3 Reduction schemes

Lithic raw material flaking at the site was aimed at producing a wide set of blanks, including both laminar pieces and flakes (Table 5.7). Products are characterized by well defined dimensional limits. Length, in particular, hardly reaches 35-40 mm. Longer bladelets are attested only in the assemblage belonging to layer 6 (up to 57 mm). Overall it seems that a single reduction scheme was applied for the exploitation of the small cherty cobbles representing the high majority of collected raw materials. The presence of longer blanks in the lowermost level is, more likely, the result of the collection of slightly larger pebbles than of a completely different reduction scheme.

5.3.1 Initialisation

Most of the cobbles were brought entire and exploited on-site. Debitage initialisation was, generally, direct. There is no evidence of shaping out phase but for the presence of a single partially crested blade belonging to layer 5b (Table 5.8). The striking platform was either created through the removal of an opening flake (more frequently) or positioned on a cortical/fractured surface. Cortical striking platforms are mostly associated with flake products. A couple a cortical flakes, both belonging to layer 5b, attest the adoption of the bipolar technique for the opening of coarse tertiary cobbles. One of them measures 50 mm in length. The actual frequency of use of this technique could, anyhow, be much underestimated. Also the opening of debitage surfaces was direct and based on the exploitation of natural round or sub-angular surfaces.

Table 5.7: Fontfaurès, l. 6, 5b, 4a. Products and by-products.

	L. 6		L. 5b		L. 4b	
Main products	**315**	**74.5%**	**382**	**68.1%**	**283**	**69.7%**
Blades	127	40.3%	124	32.5%	133	47.0%
Laminar flakes	84	26.7%	77	20.2%	64	22.6%
Flakes	104	33.0%	181	47.4%	86	30.4%
Laminar by-products	**63**	**14.9%**	**57**	**10.2%**	**50**	**12.3%**
Semi-cortical blades	31	49.2%	26	45.6%	24	48.0%
On the edge blades			2	3.5%		
Semi-cortical on the edge blades	1	1.6%	2	3.5%	2	4.0%
Naturally backed blades	18	28.6%	23	40.4%	15	30.0%
Cortical naturally backed blades	13	20.6%	4	7.0%	9	18.0%
Flake by-products	**45**	**10.6%**	**122**	**21.7%**	**73**	**18.0%**
Semi-cortical flake	32	71.1%	82	67.2%	47	64.4%
Naturally backed flakes	7	15.6%	33	27.0%	17	23.3%
Cortical naturally backed flakes	6	13.3%	7	5.7%	9	12.3%
Total	423	100%	561	100%	406	100%

Table 5.8: Fontfaurès, l. 6, 5b, 4a. Initialisation blanks.

	L. 6		L. 5b		L. 4b	
Partially crested blades			1	3.4%		
Opening blades	1	5.9%	1	3.4%	3	12.0%
Naturally crested blades	2	11.8%	4	13.8%		
Opening flakes	5	29.4%	2	6.9%	4	16.0%
Generic cortical flakes	9	52.9%	21	72.4%	18	72.0%
Total	17	100%	29	100%	25	100%

5.3.2 Production

As already pointed out flaking was aimed at obtaining a wide set of bladelets, laminar flakes and flakes, representing roughly 70% of the products. Along with them some laminar and flake by-products were produced, in particular semi-cortical and naturally backed blanks. Dimensional values of laminar artefacts are well clustered (Table 5.9; Figure 5.2). Half of them are 15-29 mm long, 7-13 mm large and 1-4 mm thick. Maximum lengths vary along the sequence as in the lowermost level bladelets and laminar by-products respectively 57 and 66 mm long are attested. Even so, these are quite rare. In layer 5b and 4b, on the other hand, the maximum bladelet length decreases to 40-35 mm. Bladelets are mostly characterized by irregular parallel edges, triangular or trapezoidal cross-sections and concave profiles. Flakes are generally shorter with mean length values attested around 15-16 mm with respect to the 20-23 mm of blades.

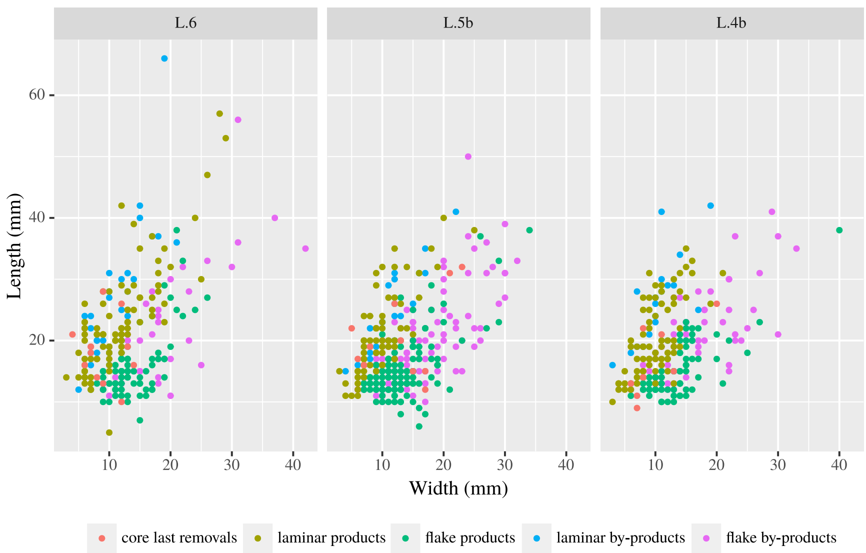

Figure 5.2: Fontfaurès, l. 6, 5b, 4a. Scatterplot of length and width values of products, by-products and core last removals.

Table 5.9: Fontfaurès, l. 6, 5b, 4a. Summary of the metric values of debitage laminar products and by-products (A = blades, B = laminar by-products, C = flakes, D = flake by-products).

		L. 6				L. 5b				L. 4b			
		A	B	C	D	A	B	C	D	A	B	C	D
Length	Min.	12	12	7	11	11	15	6	10	10	16	10	12
	1st Qu.	18	20	13	14	16	18.75	13	15	15	20.75	12	15
	Median	21.5	25	15	20	20	23.5	15	19	19	26.5	14	20
	Mean	23.34	27	16.03	22.55	20.97	24.4	15.62	20.09	20.51	26.3	15.27	20.84
	3rd Qu.	27	31	17	28	24	29.25	17	23	26	29	17.75	25
	Max.	57	66	38	56	40	41	38	50	35	42	38	41
	σ	8.54	10.87	5.48	10.18	6.72	6.83	5.18	7.29	6.31	6.97	4.59	6.99
	Count	88	29	76	33	68	20	135	102	74	20	70	56
Width	Min.	3	4	7	7	3	3	6	5	3	3	6	6
	1st Qu.	7	8	11	13	7	8	10	12	7	7	10	12.75
	Median	10	10	13	18	9	9	12	15	8	10	14	15
	Mean	10.67	10.7	14.27	18.44	8.87	10.07	13.23	16.59	8.82	9.42	13.56	16.94
	3rd Qu.	13	13	17	22	11	12	15	20	10	11	15	22
	Max.	29	21	34	42	25	22	34	42	21	19	40	33
	σ	4.97	3.61	5.06	7.4	3.37	3.91	4.63	6.43	3.11	3.29	4.93	6.26
	Count	207	60	99	45	200	57	176	120	197	50	84	72
Thickness	Min.	1	1	1	1	1	1	1	1	1	1	1	1
	1st Qu.	1	2	2	3	1	2	2	3	1	2	2	3
	Median	2	3	2	4	2	3	2	4	2	3	2	4
	Mean	2.56	3.21	2.64	4.76	2.01	3.54	2.61	4.42	2.04	3.22	2.55	4.43
	3rd Qu.	3	4	3	6	2	4	3	5	2	4	3	6
	Max.	12	9	7	20	8	16	9	18	7	12	7	13
	σ	1.64	1.68	1.18	3.34	1.12	2.4	1.46	2.7	1.04	1.88	1.31	2.62
	Count	209	61	104	45	201	57	181	122	196	50	86	72

Debitage preferentially proceeds through unidirectional sequences of removals (Figure 5.3) as indicated by the direction of the scars. In layer 6 around 9% of the bladelets is bidirectional. This value drops in the most recent layers. Numerous reorientation blanks (Table 5.10) attest that part of the cores were turned during their exploitation. These blanks are represented either by flakes featuring orthogonal removals or laminar blanks exploiting the overhang of the previous striking platform as a ridge. In some cases the debitage surface and the striking platform were switched. Apart for reorientation blanks, the maintenance of the cores is essentially testified by surface maintenance flakes (more rarely by lamellar removals). These are mostly flaked from the same striking platform, although, in particular in layer 4b, also from an opposite one. Elements connected to the maintenance of the striking platform are particularly rare and only attested in the two oldest layers.

As regards knapping techniques, for most of the flaking process a soft direct percussion with a stone hammer was used. Butts are mostly large or punctiform. The overhang was not systematically trimmed, with percentages spanning between 30-48% on bladelets and 16-32% on flakes. A few semi-cortical and cortical blanks attest the complementary use of a hard direct percussion, that can be surmised was used for opening the cobbles and creating the striking platform or debitage surface. With a similar aim was probably used the bipolar technique, that is attested by two semi-cortical flakes featuring a double bulb.

Table 5.10: Fontfaurès, l. 6, 5b, 4a. Maintenance blanks.

	L. 6		L. 5b		L. 4b	
Partial neo-crested blades	2	4.4%	1	2.9%		
Proximal reorientation blades	4	8.9%	3	8.6%	3	12.5%
Distal reorientation blades			1	2.9%		
Reorientation flakes	6	13.3%	2	5.7%	5	20.8%
Surface maintenance blades			2	5.7%		
Naturally backed surface maint. blades	1	2.2%	1	2.9%		
Surface maintenance flakes	13	28.9%	12	34.3%	5	20.8%
Naturally backed surface maint. flakes	2	4.4%	1	2.9%	2	8.3%
Maintenance flakes from opposite st. pl.	3	6.7%	1	2.9%	5	20.8%
Striking platform maintenance flakes	3	6.7%	2	5.7%		
Generic maintenance flakes	11	24.4%	9	25.7%	4	16.7%
Total	45	100%	35	100%	24	100%

5.3.3 Core analysis

The number of cores recovered during the excavation is low. Both in layer 6 and 5b, 9 cores were identified, only 7 in layer 4b (Figure 5.4). Additionally a pre-core realized on a large flake was identified in the lowermost layer. Cores belonging to layer 6 are mostly aimed at a lamellar production (Table 5.11). Similarly those belonging to layer 5b are oriented to the production of bladelets and laminar flakes. In layer 4b core are more homogeneously distributed. 2 cores of layer 6, 4 of layer 5b and 3 of layer 4b were (possibly) realized on large, mostly semi-cortical flakes.

In all of the layers the majority of the cores feature a single debitage surface (Table 5.12). In three cases all belonging to layer 6 this was exploited from two opposite

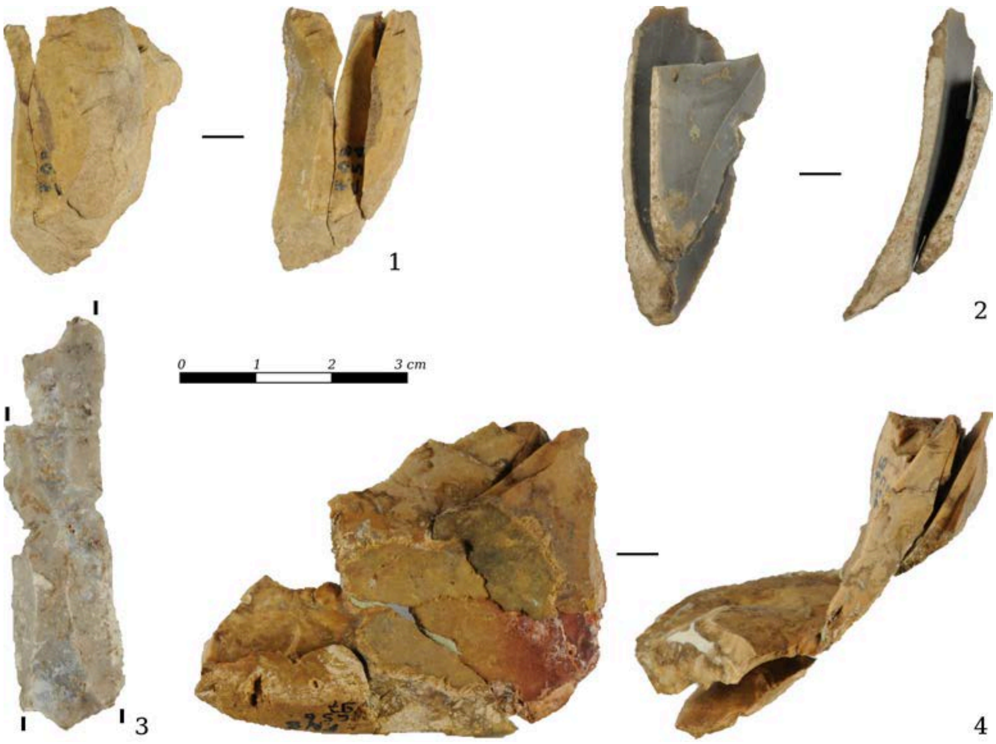

Figure 5.3: Fontfaurès, L. 6, 5b. Refitting assemblages. 1-2, unidirectional sequences (layer 6; 2 is in the good quality "fumel" chert), 3, conjoining of the fragments of a large blade (layer 6); 4, orthogonal sequence (layer 5b).

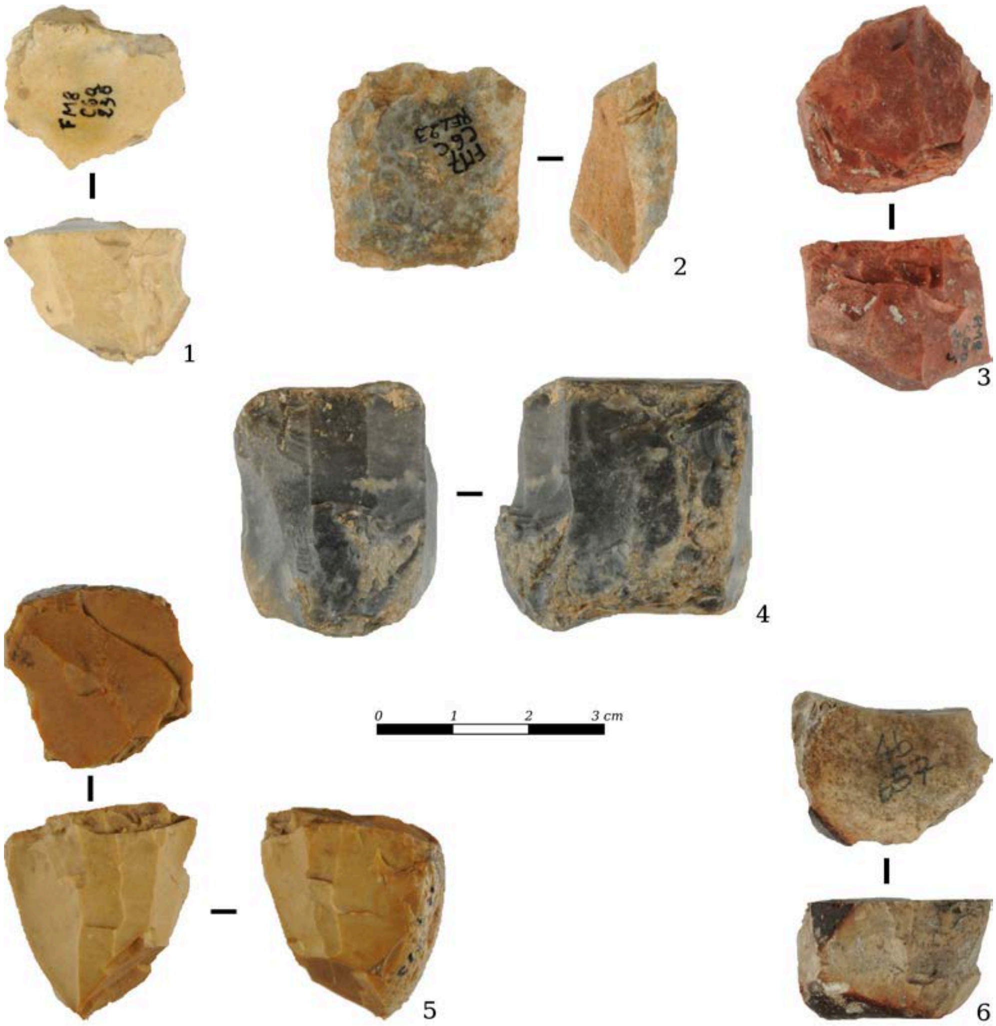

Figure 5.4: Fontfaurès, L. 6, 4b. Cores (1-4 layer 6; 5-6 layer 4b).

striking platforms (Table 5.13). The other cores have two consecutive or two opposite debitage surfaces or even three or more. The former case is relatively more frequent in layer 5b and 4b while the latter in layer 6. The presence of three or more surfaces is always correlated to the presence of more than three striking platforms. As regards cores realized on cobbles, most of the debitage surfaces were exploited with a semi-tournant or wide facial rhythm. Flake-cores, on the other hand were exploited as burin-like cores or endscraper-like cores. In line with the data yielded by the analysis of debitage blanks, the overhang was not regularly trimmed (22-44%). Generally cores were abandoned following the occurrence of a debitage accident such as a hinged removal. Only 5 cores belonging to layer 6 and 5b were completely exploited before being discarded. Three of layer 4b cores, on the other hand, were probably abandoned as a consequence of the poor quality of the raw material.

Table 5.11: Fontfaurès, l. 6, 5b, 4a. Objective of the production attested by core last removals.

	L. 6		L. 5b		L. 4b	
Bladelets	5	50.0%	4	44.4%	2	28.6%
Laminar flakes			3	33.3%	1	14.3%
Flakes	1	10.0%	1	11.1%	2	28.6%
Mix	3	30.0%	1	11.1%	1	14.3%
Undetermined					1	14.3%
Total	9	100%	9	100%	7	100%

Table 5.12: Fontfaurès, l. 6, 5b, 4a. Number and relative position of debitage surfaces.

	L. 6		L. 5b		L. 4b	
One	5	55.6%	4	44.4%	3	42.9%
Two consecutive	1	11.1%	2	22.2%	2	28.6%
Two opposite			2	22.2%	1	14.3%
Three or more	3	33.3%	1	11.1%	1	14.3%
Total	9	100%	9	100%	7	100%

Table 5.13: Fontfaurès, l. 6, 5b, 4a. Number and relative position of striking platforms (ds = debitage surface).

	L. 6		L. 5b		L. 4b	
One	2	22.2%	4	44.4%	3	42.9%
One +1 secondary	1	11.1%	1	11.1%	2	28.6%
Two opposites - same ds	3	33.3%				
Two orthogonal - same ds			1	11.1%		
Two orthogonal - diff. ds			2	22.2%		
Three					1	14.3%
More than three	3	33.3%	1	11.1%	1	14.3%
Total	9	100%	9	100%	7	100%

5.4 Blanks selection and transformation

5.4.1 Microlithic armatures

Blanks selected for the manufacture of microlithic armatures belong to a wide set of technological classes. Most frequently bladelets were selected in all the three analysed layers (Table 5.14). Moreover other laminar artefacts such as semi-cortical and naturally backed bladelets, along with a few flakes and semi-cortical flakes were used. For more than half of the microliths it was not possible to precisely determine the original blank and they were thus attributed to a generic (bladelets/flakes) or undetermined category. Apparently no pattern is attested between these technological classes and microliths typology.

Table 5.14: Fontfaurès, l. 6, 5b, 4a. Blanks selected for the production of microlithic armatures.

	L. 6		L. 5b		L. 4b	
Bladelets	22	40.7%	34	40.0%	21	43.8%
Bladelets/flakes	27	50.0%	42	49.4%	26	54.2%
Nat. backed bladelets	2	3.7%	2	2.4%	1	2.1%
Semi-cortical bladelets			2	2.4%		
Flakes	3	5.6%	3	3.5%		
Semi-cortical flakes			2	2.4%		
Undetermined			4	4.7%		
Total	54	100%	85	100%	48	100%

Blanks were transformed into microliths by means of direct retouches. More rarely a bipolar retouch was applied (mostly attested on pointed backed fragments). The use of the microburin technique is not homogeneous along the sequence. It is attested in the lower level by the presence of 25 microburins, 3 fractured notches and 13 *piquant-trièdre* (Table 5.15). This evidence decreases consistently in the middle level (3 microburins and 3 *piquant-trièdre*) and almost disappears in the later one (2 microburins). As regards the microburin assemblage, proximal elements are more frequent than distal ones. The notch, on the other hand, was shaped on both lateral edges, without a clear preference.

Table 5.15: Fontfaurès, l. 6, 5b, 4a. Wastes of the transformation phase.

	L. 6		L. 5b		L. 4b	
Proximal microburins	19	67.9%	2	66.7%	1	50.0%
Distal microburins	6	21.4%	1	33.3%		
Fractured notches	3	10.7%			1	50.0%
Total	28	100%	3	100%	2	100%

From a typological point of view the assemblages are composed of numerous classes of artefacts, among which the most populated are backed points, triangles and backed fragments (Table 5.16; Figures 5.5 and 5.6). In the lower layer backed points are exclusively represented by large types with natural base and a more or less oblique backed side realized with the microburin technique (at least 7 of them). In 9 cases the

Table 5.16: Fontfaurès, l. 6, 5b, 4a. Microlithic armatures

	L. 6		L. 5b		L. 4b	
Backed points	14	25.9%	20	22.5%	8	16.7%
Sauveterre			*11*	*12.4%*	*5*	*10.4%*
natural base	*14*	*25.9%*	*7*	*7.9%*	*2*	*4.2%*
retouched base			*2*	*2.2%*	*1*	*2.1%*
Crescents	4	7.4%	1	1.1%		
Scalene triangles	13	24.1%	25	28.1%	19	39.6%
Isoscele triangles	3	5.6%	5	5.6%		
Scalene trapezes	1	1.9%				
Backed bladelets	1	1.9%			1	2.1%
Backed-and-truncated bladelets	1	1.9%	2	2.2%		
Backed fragments	16	29.6%	32	36.0%	20	41.7%
backed fr.	*9*	*16.7%*	*22*	*24.7%*	*18*	*37.5%*
pointed backed fr.	*6*	*11.1%*	*3*	*3.4%*	*1*	*2.1%*
pointed double backed fr.			*6*	*6.7%*		
backed-and-truncated fr.	*1*	*1.9%*	*1*	*1.1%*	*1*	*2.1%*
Under construction	1	1.9%	4	4.5%		
Total	54	100%	89	100%	48	100%

pointed end was located on the proximal part of the blank. Their number decreases drastically in the two other layers (respectively 7 and 2 artefacts), that, on the other hand, attest the presence of different typologies such as Sauveterre-like and backed points with retouched base. The former includes mostly single-pointed elements with total retouched backs and distal points. Two of them, both belonging to layer 5b feature a convex retouched base. The presence of simple partial retouches is occasional (5). In all of the 3 backed points with retouched base, the transversal retouch is inverse and located in the proximal end.

As regards geometric armatures a few differences can be highlighted between the levels. In the 3 lower ones crescents, scalene and isosceles triangles are attested, while only scalene triangles in the latter (4b). Minor differences can be highlighted also among these latter, as in the older layer the third side was never modified. In the two latter around half of them present a complementary retouch and respectively 10 and 12.5% a backed third side (Table 5.17). Moreover in respectively 3 and 4 artefacts the point is unfinished (either a part of the butt or of the distal end is preserved). As already pointed out in previous studies (Valdeyron, 1994), also dimensional values vary along the series (Table 5.18). The mean length and width gradually decrease from the older level onward. The major difference, anyhow, is represented by the increase of the length/width ratio, mostly due to the shortening of the small base.

Furthermore the microlith assemblage is composed of one (unusual) scalene trapeze, two backed bladelets, three backed-and-truncated bladelets, five armatures abandoned under construction and 68 backed fragments. Among these latter are attested (double backed) pointed fragments that could either correspond to triangles or backed points and backed-and-truncated fragments that most likely constituted triangular microliths. The trapeze shows a strong similarity with backed points with natural base, presenting a straight oblique truncation manufactured with the microburin technique. It could

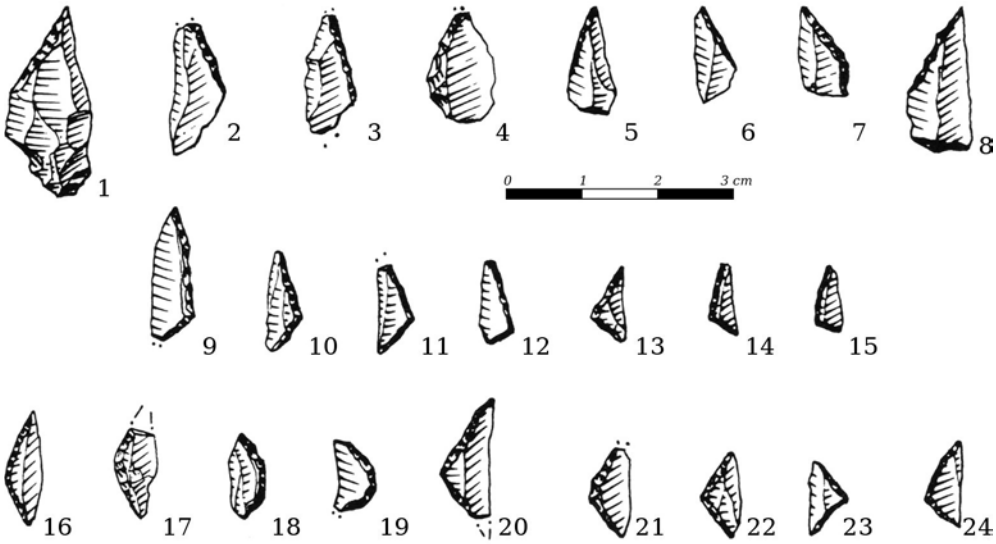

Figure 5.5: Fontfaurès, L. 6. Microliths. 1-7, backed points with natural base; 8, bi-truncated microlith; 9-15, scalene triangles; 16-19, crescents; 20-24, iscosceles triangles (after Barbaza et al., 1991).

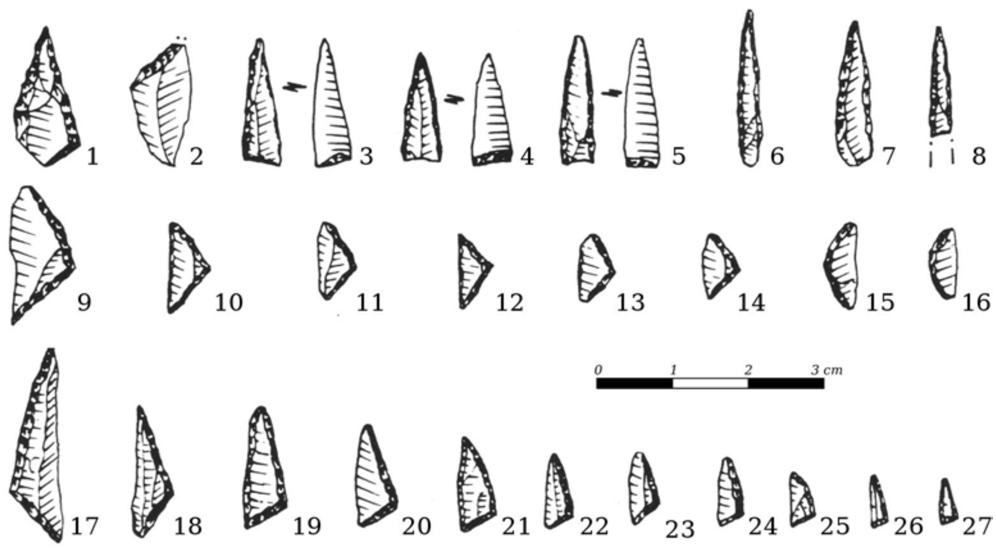

Figure 5.6: Fontfaurès, L. 5b. Microliths. 1-2, backed points with natural base; 3-5, backed points with retouched base; 6-8, Sauveterre-like backed points; 9-14, iscosceles triangles; 15-16, crescents; 17-27, scalene triangles (after Barbaza et al., 1991).

be hypothetically surmised that the base of such a point was irregularly modified for some reason, leading to a trapeze-like morphology.

Table 5.17: Fontfaurès, l. 6, 5b, 4a. Morphology of the third side of scalene triangles.

	L. 6		L. 5b		L. 4b	
Backed third side			3	12.0%	2	10.5%
Complementary retouch			13	52.0%	9	47.4%
Natural third side	13	100.0%	9	36.0%	8	42.1%
Total	13	100%	25	100%	19	100%

Table 5.18: Fontfaurès, l. 6, 5b, 4a. Summary of dimensional values of triangles.

	L. 6				L. 5b				L. 4b			
	L	W	T	L/W	L	W	T	L/W	L	W	T	L/W
Min.	8	3	1	1.8	5	2	1	1.6	6	2	1	1.8
1st Qu.	9.6	4	1	2.1	8.6	3	1	2.6	8	3	1	2.6
Median	11	5	1.5	2.6	10	4	2	2.6	10	4	2	2.5
Mean	11.6	4.6	1.6	2.6	11.0	4.2	1.5	2.7	10.0	4.2	1.5	2.8
3rd Qu.	13	5	2	3	12	5	2	3.6	12	5	2	3.3
Max.	19	6	3	3.3	25	8	2	4.2	15	7	2	4.5
σ	2.93	0.96	0.63	0.53	4.29	1.27	0.51	0.63	2.71	1.41	0.51	0.81
Count	14	16	16	14	26	30	30	26	13	21	21	13

5.4.2 Retouched tools

The number of retouched tools is low, in particular as regards layer 4b (Table 5.19). Percentages should thus be treated carefully. Generally both bladelets and flakes were selected along with a minor number of by-products. Incidentally the use of a maintenance blade (partially neo-crested blade) and of a cortical flake is also attested.

Table 5.19: Fontfaurès, l. 6, 5b, 4a. Blanks selected for the production of retouched tools

	L. 6		L. 5b		L. 4b	
Blades/bladelets	7	43.8%	2	18.2%	1	33.3%
Laminar flakes			3	27.3%		
Flakes	2	12.5%	5	45.5%		
Laminar by-products	1	6.3%				
Flake by-products	4	25.0%			2	66.7%
Initialisation blanks			1	9.1%		
Maintenance blades	1	6.3%				
Undetermined	1	6.3%				
Total	16	100%	11	100%	3	100%

Half of the 16 retouched tools (Table 5.20; Figure 5.7) belonging to layer 6 are represented by truncations, although being almost absent in the two other layers (1

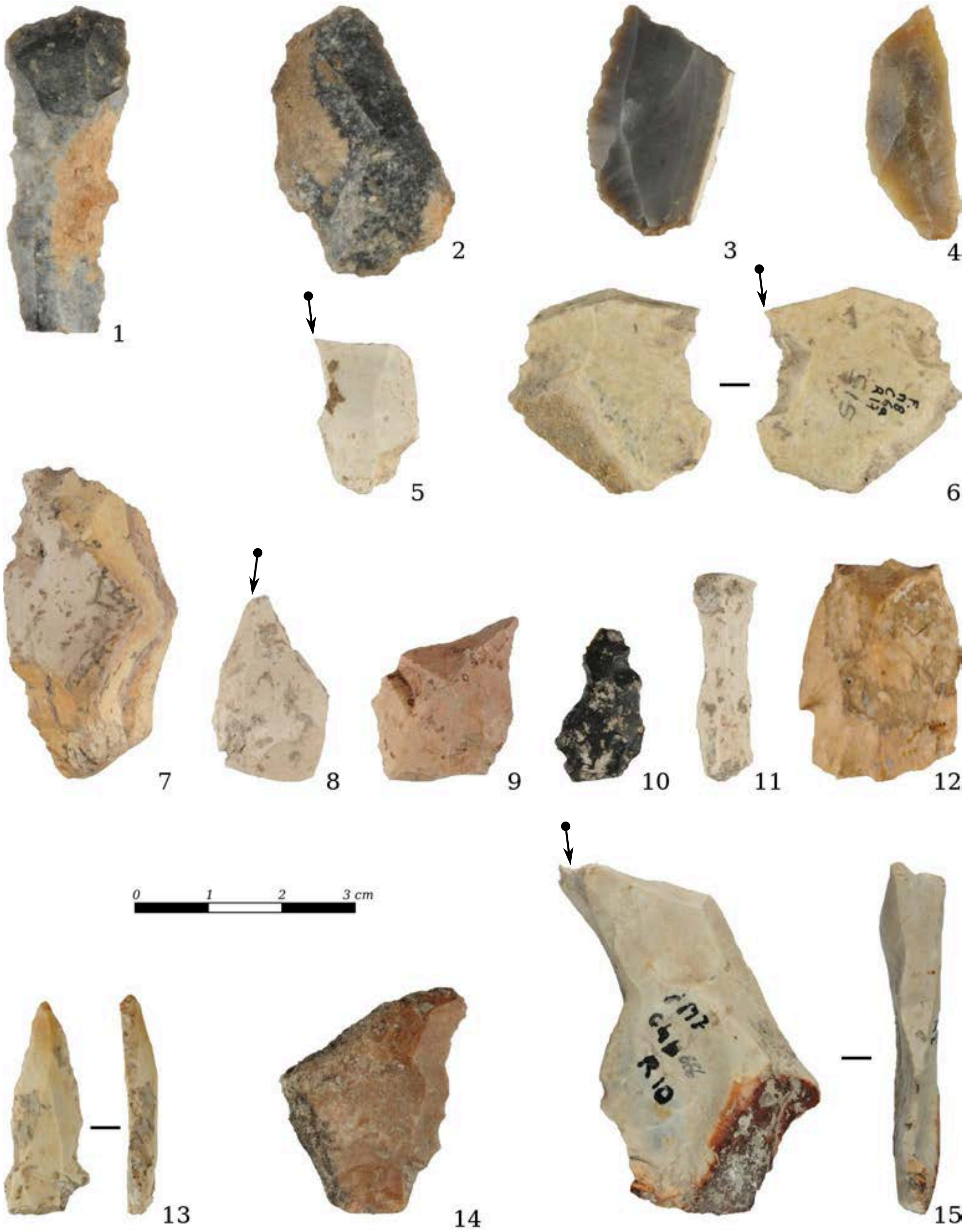

Figure 5.7: Fontfaurès, l. 6 (1-6), 5b (7-12), 4a (13-15). Retouched tools: 1-4, truncations; 5-6, burins; 7,10,12, denticulated pieces; 8, burin; 9, borer; 11, retouched bladelet; 13, borer with red colorant residues; 14, denticulated piece; 15, burin.

Table 5.20: Fontfaurès, l. 6, 5b, 4a. Retouched tools.

	L. 6		L. 5b		L. 4b	
Burins	3	18.8%	1	9.1%	1	33.3%
Endscrapers	1	6.3%				
Truncations	8	50.0%	1	9.1%		
Borers			1	9.1%	1	33.3%
Backed pieces			1	9.1%		
Backed fr.			1	9.1%		
Retouched pieces	2	12.5%	2	18.2%		
Denticulates	1	6.3%	3	27.3%	1	33.3%
Denticulated fr.	1	6.3%				
Composite tools			1	9.1%		
Total	16	100%	11	100%	3	100%

from layer 5b). These were generally manufactured on the distal end of laminar blanks such as bladelets but also on one cortical backed bladelet, one neo-crested bladelet and one flake. The length of these tools spans from 23 to 37 mm, although a fragment attests the presence of even longer artefacts. Truncations are more often oblique than perpendicular and in two cases only roughly shaped out.

Burins are one of the only two classes attested in all of the layers. Four of them were realized on flakes and flake by-products, among which two semi-cortical flakes and one naturally backed flake. The last one on a bladelet. Lengths are comprised between 22 and 46 mm. From a typological point of view, one can be considered a simple burin, one a straight angle dihedral burin and the three latter correspond to burins on fractures. One of them actually features two very short burin facets on opposite edges and could possibly represent an aborted tool.

Endscrapers are represented by a single artefact belonging to layer 6. It was manufactured on a semi-cortical flake and it is, thus, a short type.

Two borers belong to layer 5b and 4b. The former was manufactured on a laminar flake with an alternate retouch forming an asymmetric pointed end. The presence of different generation of retouches seems to attest multiple cycles of use and resharpening of the active edge. The other one, featuring an axial distal point shaped out with bilateral direct retouches, presents abundant ochre residues and a well developed rounding of the tip suggesting its use on soft/resistant materials.

Only two flakes feature irregular abrupt retouches, and four pieces semi-abrupt retouches. Two of them are bladelets and in one case retouch is inverse and attested on both sides. The two other retouched pieces are a flake and a naturally backed flake. These retouches are mostly marginal.

Six artefacts present denticulated retouches. All of them are flakes, among which one is cortical and one naturally backed. Dimensional values are included between 20 and 42 mm and thickness is variable between 5 and 13 mm. Two of them feature a denticulated retouch along one of the lateral edges, while two others along the distal transversal one. In one case retouch is bilateral and forms a pointed end while the latter piece is fragmentary. The only composite tool, that has been yielded by layer 5b, opposes a denticulated edge to a single notch.

5.5 Use and wear

The use-wear analysis of the lithic assemblages was carried out by S. Philibert (1991; 2002). 597 artefacts from layers 6 to 4b were analysed, among which 168 are retouched tools and unmodified blanks and 429 microliths (Table 5.21). Only 60 of them yielded use-wear traces (16 tools and 44 microliths). As regards the preservation state, the lithic assemblages are characterized by the presence of inhomogeneous white patinas that could have destroyed or hidden possible use-wear polishes.

Table 5.21: Fontfaurès, l. 6, 5b, 4a. The composition of the assemblage that was analysed from a functional point of view (artefacts with use-wear traces with respect to analyzed blanks) (after Philibert, 2002).

	L. 6		L. 5b		L. 4b	
Debitage	2/11	18.2%	1/22	4.5%	0/1	0.0%
Retouched tools	5/32	15.6%	7/81	8.6%	1/21	4.8%
Microliths	17/48	35.4%	26/253	10.3%	1/128	0.8%
Total	24/91		34/356		2/150	

Use-wear analysis of retouched and unretouched tools highlighted the presence of mostly short activities resulting in ephemeral traces. Only two unmodified blanks yielded 2 zones of use testifying to a longer utilization. The natural edges of laminar/lamellar blanks were mostly used with longitudinal motions on soft materials. Hard materials working, on the other hand, is much less represented and mostly connected to retouched edges, used with transversal actions. At a general level it seems that, in all the layers, activities were mostly focused on the processing of animal tissues (14 active zones out of 19). Among them butchering is the most attested one. The functional spectrum is, thus, quite reduced in term of variability reflecting the low presence of retouched tools, in particular as far as the most elaborated types are concerned.

As regards microliths the percentage of diagnostic impact fractures vary consistently between the layers. In the earliest level they are relatively abundant while almost absent in the latter one. All the microliths yielded traces that are exclusively consistent with a use as projectile elements. Among them, backed points functioned as perforating elements, hafted on the tip of the shaft. A similar use is supposed also for some elongated scalene triangles. The other geometric microliths, on the other hand, were hafted as lateral elements. Scalene triangles, in particular, were hafted with the larger base on the shaft. In most of them, in fact, a stepped micro-scarring, sometimes featuring a concave delineation, was identified on part of the natural edge. Such a pattern is attested all along the sequence and major modifications, possibly connected to the variation in the morphology of triangles, were not identified.

5.6 A nearby open-air site: Trigues

Trigues (Le Vigan, Lot) is an open-air site located around 20 km to the north-west of Fontfaurès, at 360 m a.s.l (Valdeyron et al., 2008). The site was discovered during the 1990'ies by P. Roussel during some surface prospections in the region. A high number of artefacts was identified on a surface of around 3000 square metres, in the laboured fields. In 2003 some trench-pits were dug in order to verify the possible presence of a preserved archaeological layer but they all yielded a negative outcome.

Preliminary techno-typological analyses (Valdeyron et al., 2008) revealed that the lithic assemblage is not homogenous but multiple occupation phases dated to the Mesolithic (both Early and Late) as well as to more recent phases were mixed up by post-depositional processes. The Early Mesolithic phase is reliably attested by 1 backed point and 9 triangles. The morphology of these latter, moreover, suggests a rather ancient chronology, comparable to the earliest levels of Fontafaurès.

A rapid technological analysis was carried out on the lithic assemblage and in particular focused on cores being the only class of artefacts that could be more or less reliably attributed to the different phases on the base of technological (i.e. knapping technique) and morphological criteria. Data of this analysis are here reported. They are meant as an integration of those of Fontfaurès, considering the low number of cores yielded by this site, allowing to better understand how locally available raw materials were exploited in this region.

The analysed record consists of 2072 artefacts (Table 5.22), among which 118 cores are attested. These were sorted according to the supposed chronology. Ten of them were flaked with the pressure technique and were therefore excluded from analysis. Similarly 24 other cores presenting ambiguous features were excluded. The remaining 84 cores and core fragments are consistent with an Early Mesolithic chronology. Clearly their number could be overestimated considering that the adoption of the direct percussion for the production of lamellar and flake blanks cannot be excluded for later prehistoric periods.

Table 5.22: Trigues. Composition of the studied assemblage (totality of the assemblage).

Initialisation blanks	14	0.7%
Laminar blanks	263	12.7%
Flake blanks	1158	55.9%
Maintenance blanks	39	1.9%
Burin spalls	8	0.4%
Undetermined fr.	412	19.9%
Retouched blanks	42	2.0%
Transformation wastes	18	0.9%
Cores	118	5.7%
Total	2072	100%

Table 5.23: Trigues. Objective of the production attested by core last removals (only the cores selected as compatible with a Sauveterrian reduction were included).

Bladelets	56	66.7%
Laminar flakes	11	13.1%
Flakes	5	6.0%
Mix	10	11.9%
Undetermined	2	2.4%
Total	84	100%

Most of selected cores are small sized (average of 24 mm on all axis) and are oriented to the production of lamellar blanks (Table 5.23) with length values inferior to 36 mm. It should be noted that flake cores could be underestimated as a consequence of their lower standardization and thus recognizability. Twenty-eight cores (33.3%) were realized on large, mostly semi-cortical flakes. This percentage is relatively high when considering that for 51.2% of them this parameter could not be reliably assessed.

Most cores are characterized by a single striking platform (Table 5.24), followed by those with two or more of them. The latter are generally orthogonal and oriented to the exploitation of different surfaces, probably as a result of core reorientation. The exploitation of the same debitage surface by different platforms, on the other hand, is only rarely attested. Similarly, single debitage surfaces are dominant (Table 5.25). Most surfaces are exploited with a wide frontal or semi-tournant method. Narrow frontal and on edge exploitations are attested in particular on flake-cores or on blanks of comparable morphology. Ten of them can be considered as burin-like cores. In other cases flakes were exploited also as endscraper-like cores (8) with a frontal or semi-tournant rhythm. The prosecution of the flaking process with this modality could result in prismatic semi-tournant cores (single striking platform) or in polyhedral cores (multiple platforms).

Table 5.24: Trigues. Number and relative position of striking platforms (ds = debitage surface).

One	33	39.3%
One +1 secondary	7	8.3%
Two opposites - same ds	1	1.2%
Two opposites - diff. ds	3	3.6%
Two orthogonal - same ds	2	2.4%
Two orthogonal - diff. ds	16	19.0%
Two orthogonal +1	2	2.4%
Three	10	11.9%
More than three	8	9.5%
Undetermined	2	2.4%
Total	84	100%

Table 5.25: Trigues. Number and relative position of debitage surfaces.

One	34	40.5%
Two consecutive	16	19.0%
Two opposite	8	9.5%
Three or more	24	28.6%
Undetermined	2	2.4%
Total	84	100%

Cores were mostly abandoned at the occurrence of knapping errors, notably hinged removals (45.2%) or volumetric problems (11.9%). Some of them seem to have been exploited up to their exhaustion (13.1%) while others abandoned in the absence of major issues (13.1%).

Chapter 6

Baume de Montclus

Contents

6.1 Site introduction

The Baume de Montclus (Figure 6.1) is located in the gorges of the river Ceze, along its left bank (Escalon De Fonton, 1966, 1971; Rozoy, 1978; Darmedru and Onoratini, 2003; Perrin and Defranould, 2016; Philibert, 2016). The site is located at around 30 metres from the river, under a wide south-facing rockshelter covering a surface of roughly 100 square metres. M. Escalon de Fonton excavated the site between 1954 and 1971 and brought to light a 5 metres thick stratigraphic series made up of 66 layers and sublayers. From a sedimentological viewpoint the sequence is characterized by the alternation of fine sediments resulting from recurrent overbanks and ashes connected to on-site human activities. In some levels the deposition of scree connected to weathering and erosional processes acting on the rock face is abundant, e.g. in layers 15-14. The 10 lowermost levels (from 32 to 23) have only been investigated through a small trench-pit that did not reach the bottom of the sequence. These levels were considered as partially reworked by the river floods. Among the upper layers (from 22 to 4) numerous lenticular and well defined layers rich in ashes and charcoal and with a mean diameter of 4 metres were identified. Numerous structured hearths were also identified. They are described as stone paved structures, forming a 60 centimetres large shallow depression (cf. Figure 6.1). The particularly abundant presence of charcoal remains led Escalon de Fonton to believe that fires were intentionally smothered to produce smoke for drying and smoking fish. Such hearths are attested from the Early Mesolithic (included in layer 22 and 21) to the Neolithic layers. All along the sequence stone circles with diameters spanning between 50 and 80 centimetres, realized with elongated cobbles vertically stuck into the ground are also attested. The absence of use-related evidence led to their interpretation as being part of ritual practices. In particular their correspondence with overbank deposits led to hypothesize a sort of foundation ritual connected to the cyclic return of men and waters in the site (Rozoy, 1978).

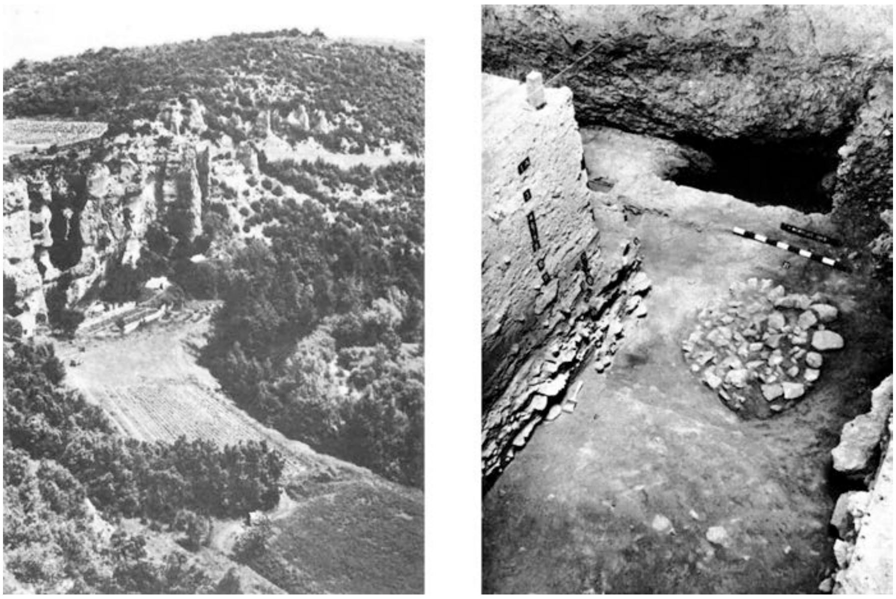

Figure 6.1: Baume de Montclus. Panoramic view on the site and particular of one of the structured hearths belonging to level 21 (after Rozoy, 1978; Escalon De Fonton, 1969).

The analysis of the lithic industries allowed the subdivision of the stratigraphic sequence into three main phases (Rozoy, 1978). The older one goes from layer 32 to layer 15 and comprises the levels that were initially attributed by Escalon de Fonton to the Mediterranean Sauveterrian; it is followed by a Castelnovian phase (layers 14-5) and an Early Neolithic one (Cardial). In 1978 Rozoy proposed that, in light of the differences with the Sauveterrian of South-Western France, the former had to be named Montclusian. This sequence was subdivided into three distinct phases: Ancient (layers 32 to 23), Middle (layers 22 to 17) and Recent Montclusian (layers 16 and 15). The ancient one is not well attested corresponding to the flood reworked layers. In the middle phase retouched tools are characterized by large dimensions (5 to 8 cm long or wide and 1 to 3 cm thick) and microlithic armatures are dominated by Montclus triangles (Barrière et al., 1969) and backed bladelets, while trapezes and microburins are not attested. The recent phase is characterized by similar assemblages with the addition of symmetric trapezes.

A rich series of radiocarbon datings allows the chronological attribution of the Montclusian levels (Table 6.1) to the Boreal chronozone, encompassing approximately the millennium between 9500 years cal BP and 8500 years cal BC.

Table 6.1: Baume de Montclus, layers 22-17. Radiocarbon datings (after Perrin and Defranould, 2016).

Layer	Laboratory Identifier	Radiocarbon date	Calibrated age (2σ)
c.15	Beta-255115	7770 ± 50	8631-8430 cal BP
c.16	Beta-253156	7670 ± 50	8554-8385 cal BP
c.16	Ly-542	7540 ± 160	8697-7999 cal BP
c.18B	Beta-255116	7720 ± 50	8590-8416 cal BP
c.21F	LY-306	7780 ± 250	9301-8056 cal BP
c.21F	LY-305	7890 ± 170	9243-8385 cal BP
c.22	LY-308	7750 ± 340	9452-7966 cal BP
c.22	LY-307	7770 ± 410	9596-7790 cal BP
c.22	KN-58	8130 ± 240	9540-8455 cal BP
c.23	MC-730	7950 ± 100	9076-8545 cal BP

Anthracological analyses carried out by Bazile-Robert (1983) show that during the Middle Montclusian climate became more humid. Juniper and almond regressed with respect to the previous phases and scots pines disappeared while oak became more abundant. During the Recent Montclusian and Castelnovian the climate was even more temperate and humid and the oak forest was dominant.

The detailed study of faunal remains is currently on-going. Published data only indicates the presence of few red deer and boar remains along with extremely numerous fish vertebrae (Rozoy, 1978). Artefacts manufactured on animal materials are scarce and represented by two awls and a few worked fragments. The presence of ochre residues and perforated *Columbella rustica* shells has also been highlighted.

6.2 Lithic assemblages

A total of 7857 lithic artefacts belonging to layers 17 to 28 was analysed. All the artefacts were divided into general technological classes as reported in Tables 6.2 and 6.3. Categories in the two tables are slightly different as for the assemblages that were only sorted into groups and not individually studied, a more detailed subdivision in technological classes has been reported. The assemblages of layers 17, 19 and 21 as well as the cores and retouched artefacts of the other layers were the object of a detailed techno-economic analysis. The entire assemblage of layer 17 and a selection of artefacts belonging to the other layers were also studied from a functional viewpoint.

The artefacts belonging to the oldest layers (28 to 23) are scarce (totally less than 500) and considering that these are supposed to have been reworked by the river floods, they were excluded from the present analysis.

As to the preservation state more than 50% of the artefacts are burnt or thermally altered (Table 6.4). This percentage varies importantly along the series from 66.6% of layer 17 to 39.1% of layer 22. Mechanical damages are diffused and they mainly affect the edges of the artefacts at a microscopic level while macroscopic breakages are less frequent (Table 6.5).

Table 6.2: Baume de Montclus, l. 21, 19, 17. Composition of the lithic assemblages of the three layers analysed in detail.

	L. 21		L. 19		L. 17	
Cortical and semi-cortical blanks	228	11.8%	87	15.7%	214	11.2%
Laminar blanks	358	18.5%	155	27.9%	425	22.3%
Flake blanks	206	10.6%	96	17.3%	241	12.7%
Maintenance blanks	97	5.0%	43	7.7%	38	2.0%
Burin spalls	1	0.1%	2	0.4%	3	0.2%
Undetermined fr.	764	39.4%	111	20.0%	716	37.6%
Flakes < 1 cm	180	9.3%	24	4.3%	146	7.7%
Retouched blanks	75	3.9%	28	5.0%	112	5.9%
Transformation wastes	1	0.1%	1	0.2%	2	0.1%
Cores	28	1.4%	8	1.4%	6	0.3%
Total	1938	100%	555	100%	1903	100%

Table 6.3: Baume de Montclus, l. 28-22, 20, 18. Composition of the lithic assemblages of the remaining layers.

	L. 28	L. 27	L. 24	L. 23	L. 22	L. 20	L. 18
Initialization & semi-cort. flakes	2		9	32	66	66	63
Blades & laminar flakes	7	9	22	46	121	179	155
Laminar by-products	4		7	27	59	96	81
Flakes	7		44	105	278	248	219
Maintenance blanks	2		1	12	25	30	31
Burin spalls					3	1	1
Undetermined fr.	6		54	82	214	341	254
Flakes < 1 cm			6	9	48	121	108
Retouched blanks	1		1		7	33	72
Transformation wastes							1
Cores			1	2	13	14	13
Total	29	9	145	315	834	1129	998

6.3 Raw materials provisioning

In all the three analysed layers raw materials are almost entirely represented by well silicified cherts that are available in the surrounding of the rockshelter. Previous studies identified two possible sources that are represented by Eocene cherts outcropping in the area of Orgnac, no more than 5 kilometres to the north of the site, and Lower Cretaceous ones that can be found on the right bank of the Rhone, around 20 kilometres to the north-east (Darmedru and Onoratini, 2003). The exploitation of low silicified limestones is attested by a few artefacts along with two quartzite flakes (Table 6.6).

The analysis of cortical surfaces revealed that provisioning took place mostly in slope deposits next to the outcrops (80.9-90.2%). Less frequently blanks were collected in primary deposits, soils and river beds. Collected blocks are represented by large flattish slabs, 3 to 5 cm thick and several centimetres long (at least 10 in most cases) as well as smaller ones.

As far as lithologies are concerned, procurement strategies do not change in the

Table 6.4: Baume de Montclus, l. 22-17. Thermal alteration of the artefacts.

	L. 22		L. 21		L. 20		L. 19		L. 18		L. 17	
Unaltered	508	60.9%	911	47.0%	678	60.1%	324	58.4%	576	57.7%	636	33.4%
Burnt	326	39.1%	1027	53.0%	451	39.9%	231	41.6%	422	42.3%	1269	66.6%

Table 6.5: Baume de Montclus, l. 21, 19, 17. Integrity of the assemblage.

	L. 21		L. 19		L. 17	
Entire	512	26.4%	179	32.3%	447	23.5%
Incomplete	316	16.3%	121	21.8%	244	12.8%
Fragments	1110	57.3%	255	45.9%	1214	63.7%
Total	1938	100%	555	100%	1905	100%

three analysed layers. The only consistent difference is represented by the collection of blocks directly in the primary outcrops during the most recent phase (layer 17). Moreover a difference in the quality of collected cherts can be appreciated. While in layer 21 a high number of artefacts is characterized by the presence of numerous macroscopic fossils (often a few millimetres large) giving debitage surfaces an irregular aspect, the selection of finer and more homogeneous cherts can be observed in the more recent layers.

6.4 Reduction schemes

The exploitation of lithic raw materials was oriented to the production of a varied set of products including both laminar blanks and flakes according to two interrelated reduction schemes, encompassing a wide set of technical procedures.

The first reduction scheme was aimed at the exploitation of the largest slabs. At the beginning naturally and often cortical backed blades and semi-cortical blades were obtained, while during the second phase a wide set of smaller blanks such as bladelets, laminar flakes and flakes were produced (Table 6.7). The latter also represent the aim of the second reduction scheme that started with smaller slabs and large flakes produced in the very earliest phases of the first reduction scheme.

Table 6.6: Baume de Montclus, l. 21, 19, 17. Raw material exploitation.

	L. 21		L. 19		L. 17	
Chert	585	9.,5%	267	96.7%	446	93.5%
Limestone	5	0.8%	3	1.1%	9	1.9%
Quartz	1	0.2%	1	0.4%		
Different	15	2.5%	5	1.8%	22	4.6%
Total	606	100%	276	100%	477	100%

Table 6.7: Baume de Montclus, l. 21, 19, 17. Products and by-products.

	L. 21		L. 19		L. 17	
Main products	**512**	**66.6%**	**212**	**65.2%**	**562**	**65.0%**
Blades/bladelets	157	20.4%	106	32.6%	314	36.4%
Laminar flakes	41	5.3%	30	9.2%	57	6.5%
Flakes	314	40.8%	76	23.4%	191	22.1%
Laminar by-products	**86**	**11.2%**	**44**	**13.5%**	**177**	**20.5%**
Semi-cortical blades/bladelets	30	3.9%	12	3.7%	46	5.3%
On-edge blades/bladelets	4	0.5%			5	0.6%
Semi-cort. on-edge blades/bladelets	4	0.5%			4	0.5%
Naturally backed blades/bladelets	26	3.4%	19	5.8%	50	5.8%
Cortical backed blades/bladelets	22	2.9%	13	4.0%	72	8.3%
Flake by-products	**171**	**22.2%**	**69**	**21.2%**	**126**	**14.5%**
Semi-cortical flakes	93	12.1%	31	9.5%	55	6.3%
Naturally backed flakes	44	5.7%	20	6.2%	50	5.8%
Cortical backed flakes	34	4.4%	18	5.5%	21	2.4%
Total	769	100%	325	100%	865	100%

6.4.1 Initialization

In both reduction schemes, selected blocks feature natural angles that were directly exploited for the initialization of the debitage without previous shaping out or decortication. In fact, the majority of the initialization elements are composed of naturally crested blades, cortical blades and cortical flakes (Table 6.8). The only exception is represented by two cores, both belonging to layer 21, realized on small flattish slabs. These were shaped out prior to their exploitation by means of orthogonal bifacial removals all along their perimeter forming a sort of crest. Considering the low exploitation rate and the poor raw material quality their presence is peculiar and difficult to explain.

Table 6.8: Baume de Montclus, l. 21, 19, 17. Initialization blanks.

	L. 21		L. 19		L. 17	
Opening blades	1	4.3%	2	15.4%		
Naturally crested blades	3	13.0%	1	7.7%	3	17.6%
Opening flakes	6	26.1%	2	15.4%	4	23.5%
Generic cortical flakes	13	56.5%	8	61.5%	10	58.8%
Total	23	100%	13	100%	17	100%

6.4.2 Production

In all the investigated layers the first reduction scheme was, initially, aimed at the production of large laminar blanks whose length ranges between 40 and 112 mm (Figure 6.2, Table 6.9). These blanks are mostly represented by natura, and often cortical, backed blades along with semi-cortical blades that were obtained through the unipolar facial exploitation of the narrower faces of the slabs, along their maximal length. In some cases an opposite striking platform was opened leading to a bipolar exploitation. Considering the almost complete absence of *plein débitage* blades fitting this early phase it can be argued that these blanks were, actually, the main aim of the production. This assumption is enforced by the analysis of retouched artefacts and use-wear evidence (cf. *infra*). These blanks are generally quite thick (around 5 mm) and plunged and they feature large butts with untrimmed overhanging portions. They were obtained by direct percussion with a stone hammer. Presumably part of the cores were discarded at this stage of the reduction scheme as attested by the length of the last removals on some of them (Figure 6.2).

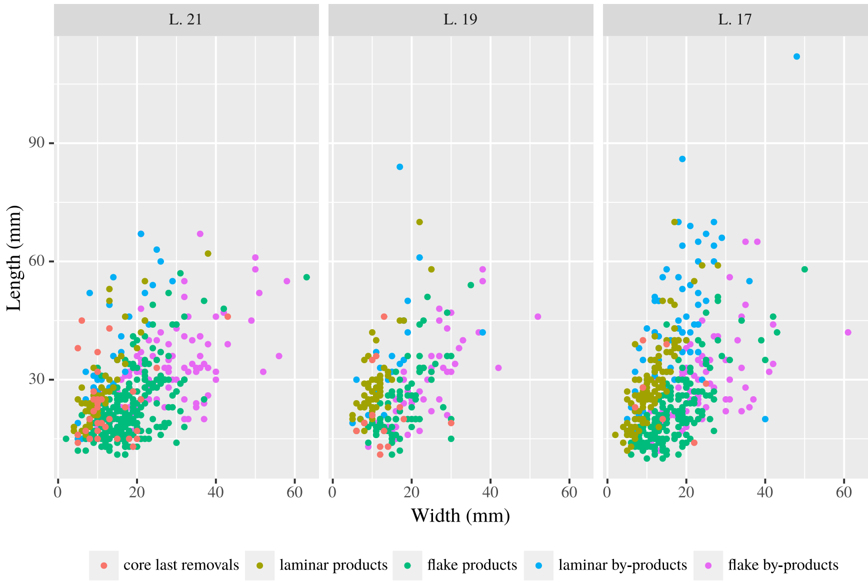

Figure 6.2: Baume de Montclus, l. 21, 19, 17. Scatterplot of length and width values of products, by-products and core last removals.

At a later stage, reduction strategies differentiated and multiple solutions were adopted allowing the obtention of a wide set of products with length spanning between 15 and 45 mm (Figure 6.2, Table 6.9). Along with proper bladelets and flakes also backed and semi-cortical by-products were obtained (Table 6.7). A major change in the modalities these blanks were obtained can be highlighted between the oldest levels (24-20) and the most recent ones (19-17). In the former cores continued to be exploited either unidirectionally or, more frequently, through orthogonal reorientations as testified by proximal (along the overhang) and distal reorientation blades and flakes (Table 6.10) or by switching striking platform and debitage surface. The other maintenance elements attested in these levels are mostly represented by surface maintenance flakes and blades detached from the same striking platform with the aim of removing hinged negatives and restoring the correct longitudinal convexity. The transversal convexity, on the other hand, was maintained through removals on the two sides of the core, contextual to the main production phase (naturally backed blanks).

Table 6.9: Baume de Montclus, l. 21, 19, 17. Summary of the metric values of debitage products and by-products (A = blades, B = laminar by-products, C = flakes, D = flake by-products).

		L. 6				L. 5b				L. 4b			
		A	B	C	D	A	B	C	D	A	B	C	D
Length	Min.	16	15	11	13	17	19	11	13	12	17	10	12
	1st Qu.	22	25.5	17	22	23.25	23.5	18	20	22	30	15	22
	Median	25	30	21	29	27.5	30	22	26	28	41	20	27.5
	Mean	27.86	34.05	22.67	29.85	28.95	32.78	25.01	28.92	29.17	41.96	21.98	28.96
	3rd Qu.	30	43.25	27	35	30	35.5	30	34	35	51.5	26	34.75
	Max.	62	67	57	67	70	84	64	58	70	112	58	65
	σ	10.22	13.94	8.25	10.78	9.18	14.06	9.94	10.92	10.56	17.68	8.79	10.47
	Count	51	34	254	127	50	20	75	41	97	68	174	82
Width	Min.	4	4	2	7	4	3	9	8	2	5	6	5
	1st Qu.	8	9	13	18	8	3.25	14.25	18	7	9	12	17
	Median	9	11.5	17	23	10	12	18	23	9	13	16	21
	Mean	10.2	13.36	17.85	25.1	11.08	12.88	19.1	24.31	9.69	14.16	17.11	22.39
	3rd Qu.	12	17	22	32	12	17	22	30	12	19	21	26.5
	Max.	38	29	63	58	25	23	45	52	28	48	50	61
	σ	4.35	6.27	7.08	10.05	3.99	6.44	6.85	9.35	4.32	7.06	7.36	8.72
	Count	149	78	328	158	97	35	92	59	306	167	229	112
Thickness	Min.	1	1	1	1	1	1	1	2	1	1	1	2
	1st Qu.	2	3	2	4	2	3	2	4	2	3	2	4
	Median	2	4	3	5	2	4	3	6	2	4	3	5
	Mean	2.48	4.84	3.71	6.38	3.18	4.44	4.02	6.29	2.56	5.18	3.66	6.1
	3rd Qu.	3	6	5	8	4	5	5	8	3	7	5	8
	Max.	8	20	22	35	39	14	16	17	11	16	12	22
	σ	1.25	3.29	2.46	4.36	3.81	2.58	2.59	3.35	1.49	3.23	2.19	3.17
	Count	149	78	345	162	98	36	98	61	306	169	239	118

In the latter set of layers (19-17) an additional reduction modality appeared accompanied by a shift from the almost exclusive presence of debitage surface maintenance elements to the preponderance of striking platform rejuvenation flakes and *tablettes* (Table 6.10). These elements seem functional to the rapid reduction of the length of the debitage surface for the obtention of shorter blanks. The lower number of surface maintenance blanks can be explained with a more careful and controlled debitage with respect to lower levels, oriented to the production of regular, elongated and standardized elements, as testified by the higher percentage of bladelets (from 20.4% in layer 21 to 36.3% in layer 17). The increase of lamellar production is balanced out by a decrease in flake production (Table 6.7).

Table 6.10: Baume de Montclus, l. 21, 19, 17. Maintenance blanks.

	L. 21		L. 19		L. 17	
Neo-crested blades	3	3.1%				
Partially neo-crested blades	1	1.0%	1	2.3%		
Proximal reorientation blades	5	5.2%	2	4.7%	3	7.9%
Distal reorientation blades			1	2.3%		
Reorientation flakes	8	8.2%	2	4.7%	5	13.2%
Distal reorientation flakes					1	2.6%
Surface maintenance blades	3	3.1%	1	2.3%		
Naturally backed surface maint. blades	1	1.0%	3	7.0%		
Surface maintenance flakes	37	38.1%	18	41.9%	8	21.1%
Maint. flakes from opposite st. pl.	2	2.1%	2	4.7%		
Tablettes					5	13.2%
Striking pl. rejuvenation flakes	5	5.2%	6	14.0%	7	18.4%
Generic maintenance flakes	32	33.0%	7	16.3%	9	23.7%
Total	97	100%	43	100%	38	100%

The second reduction scheme was dedicated to the exploitation of small sized blanks that are either represented by slabs or large (semi-)cortical flakes produced at the beginning of the first reduction scheme. The products of the second reduction scheme can be assimilated to those of the second phase of the first one, as can the modalities they were obtained with, at least as far as small slabs are concerned. Large flakes were exploited either as burin-like cores or as endscraper-like ones.

Knapping techniques do not change neither from one reduction scheme to the other nor along the sequence. The use of a stone hammer direct percussion can be inferred by the analysis of butt features, generally large and with accentuated striking points, and blank morphologies. Overhanging striking platform portions were not systematically trimmed, although moving from layer 21 to layer 17 a progressive increase in the preparation of core surfaces can be appreciated. In particular trimming percentage is attested respectively at 33.7%, 38.4% and 62.7% on blades and bladelets and at 19.1%, 17.2% and 36.6% on flakes and by-products.

6.4.3 Core analysis

A total of 82 cores were identified in layer 17 to 22 and analysed from a technological point of view (Figures 6.3; 6.4; 6.5; 6.6). Most are characterized by the presence of a single debitage surface (Table 6.11) and a single striking platform (Table 6.12). More

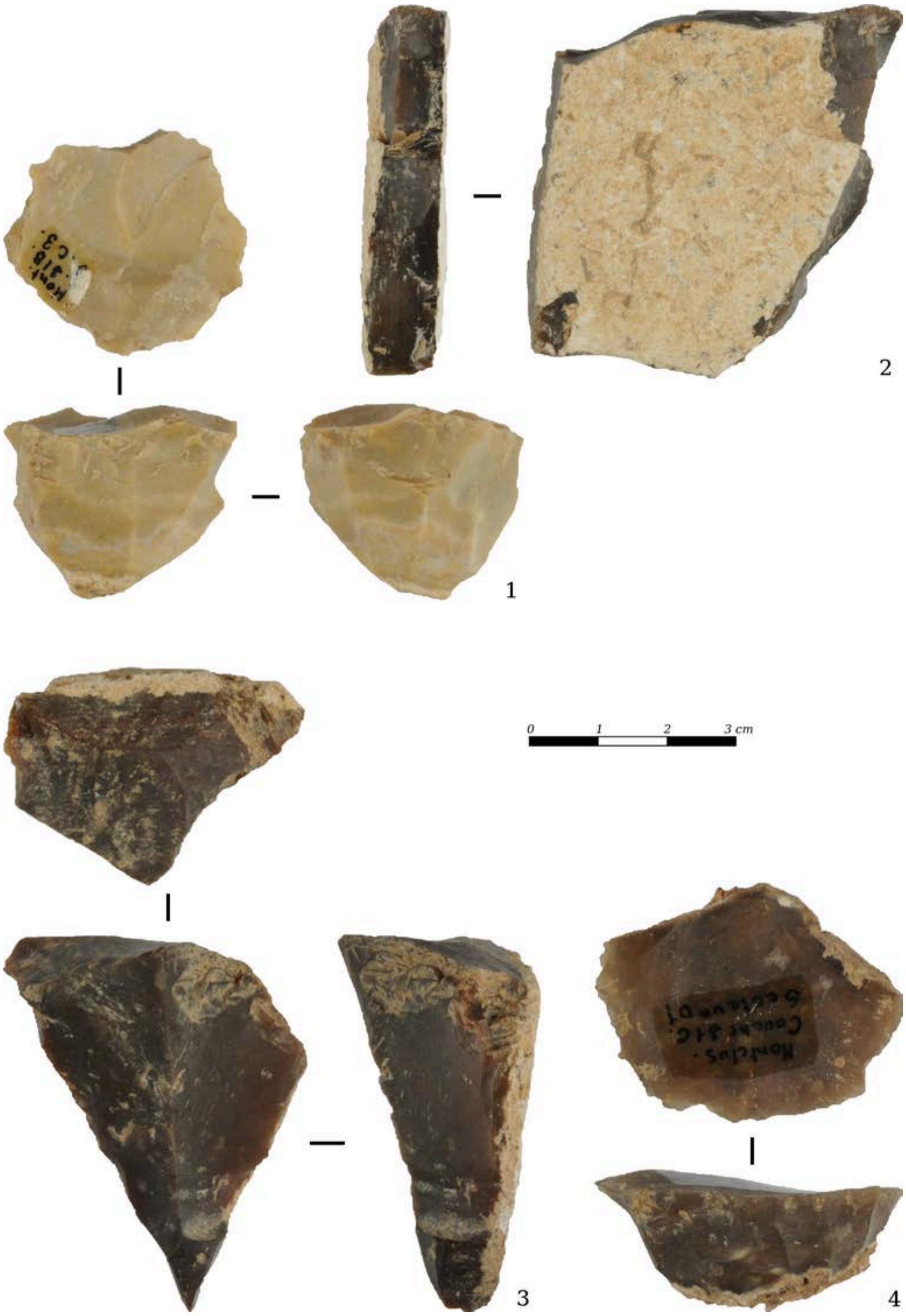

Figure 6.3: Baume de Montclus, L. 21. Laminar (2, 3) and lamellar/flake cores (1,4).

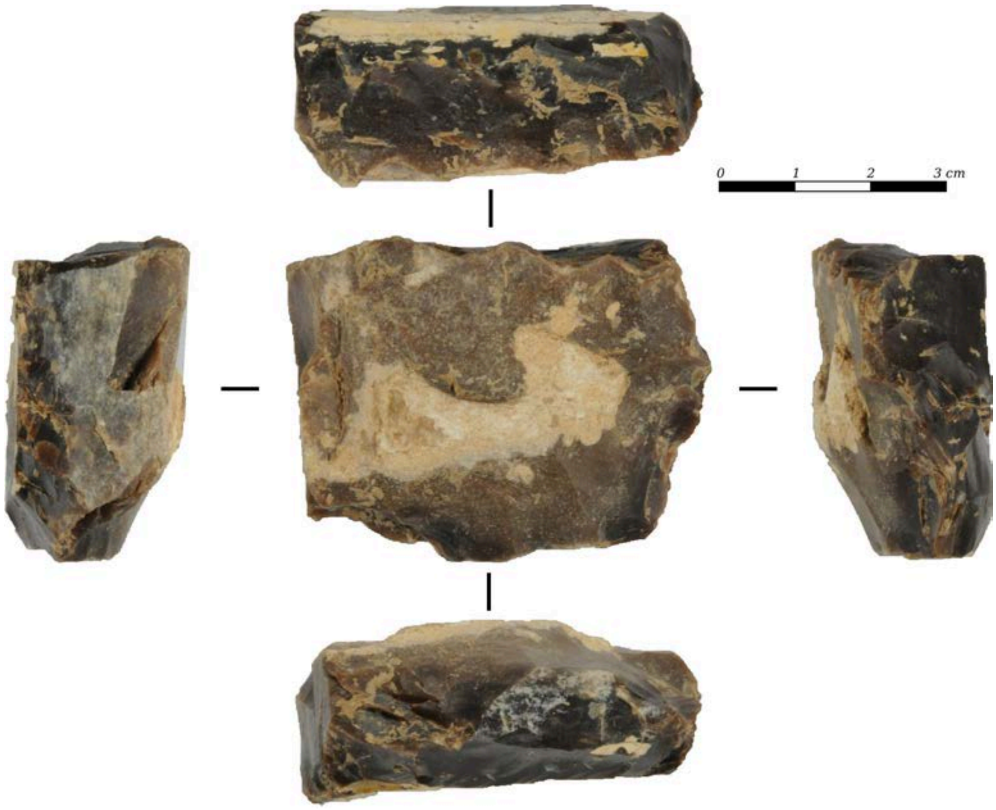

Figure 6.4: Baume de Montclus, L. 21. Unexploited core (a single hinged removal) realized on a slab by shaping out a sort of crest on all the four sides.

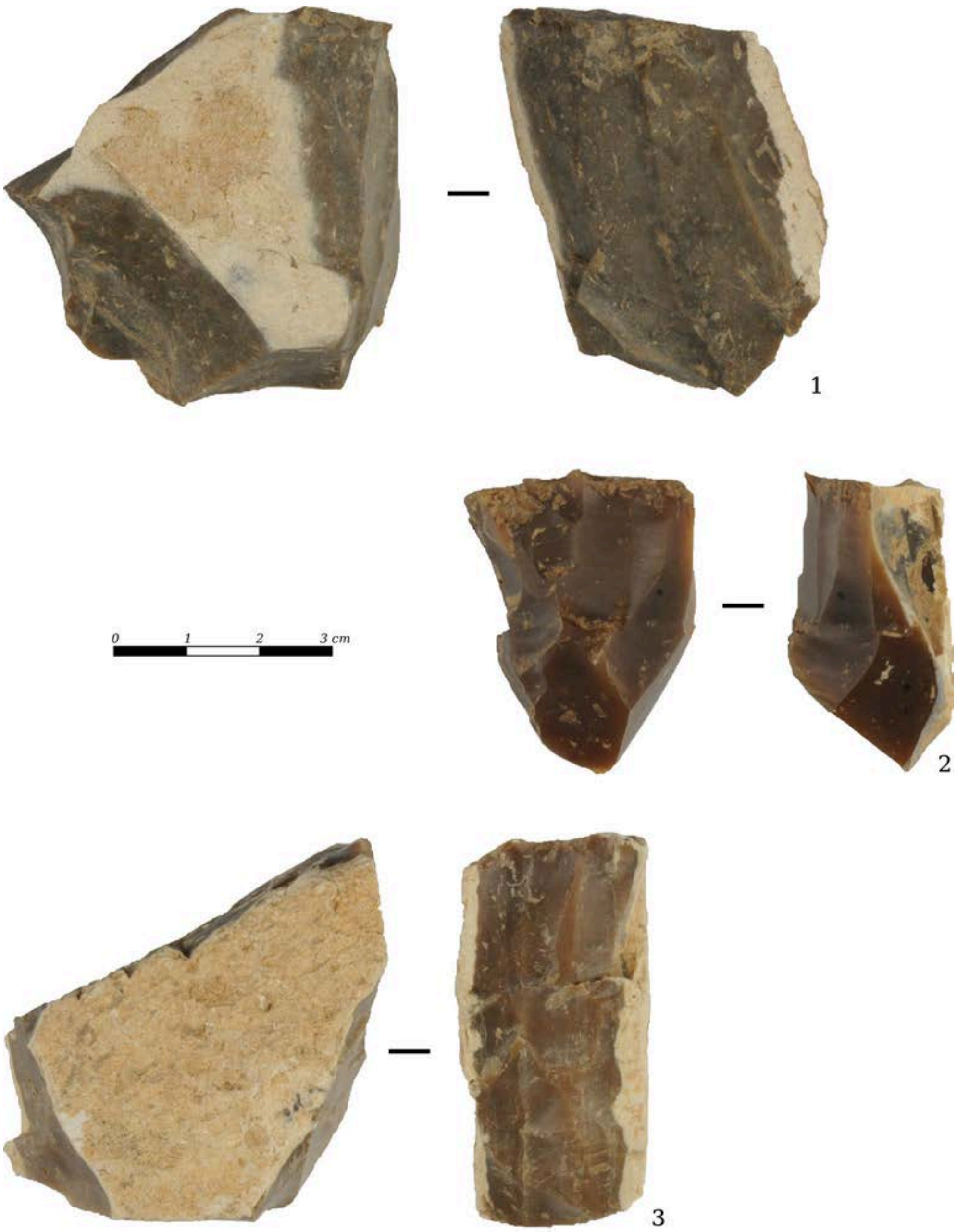

Figure 6.5: Baume de Montclus, L. 20-19. Laminar (1, 3) and lamellar cores (2).

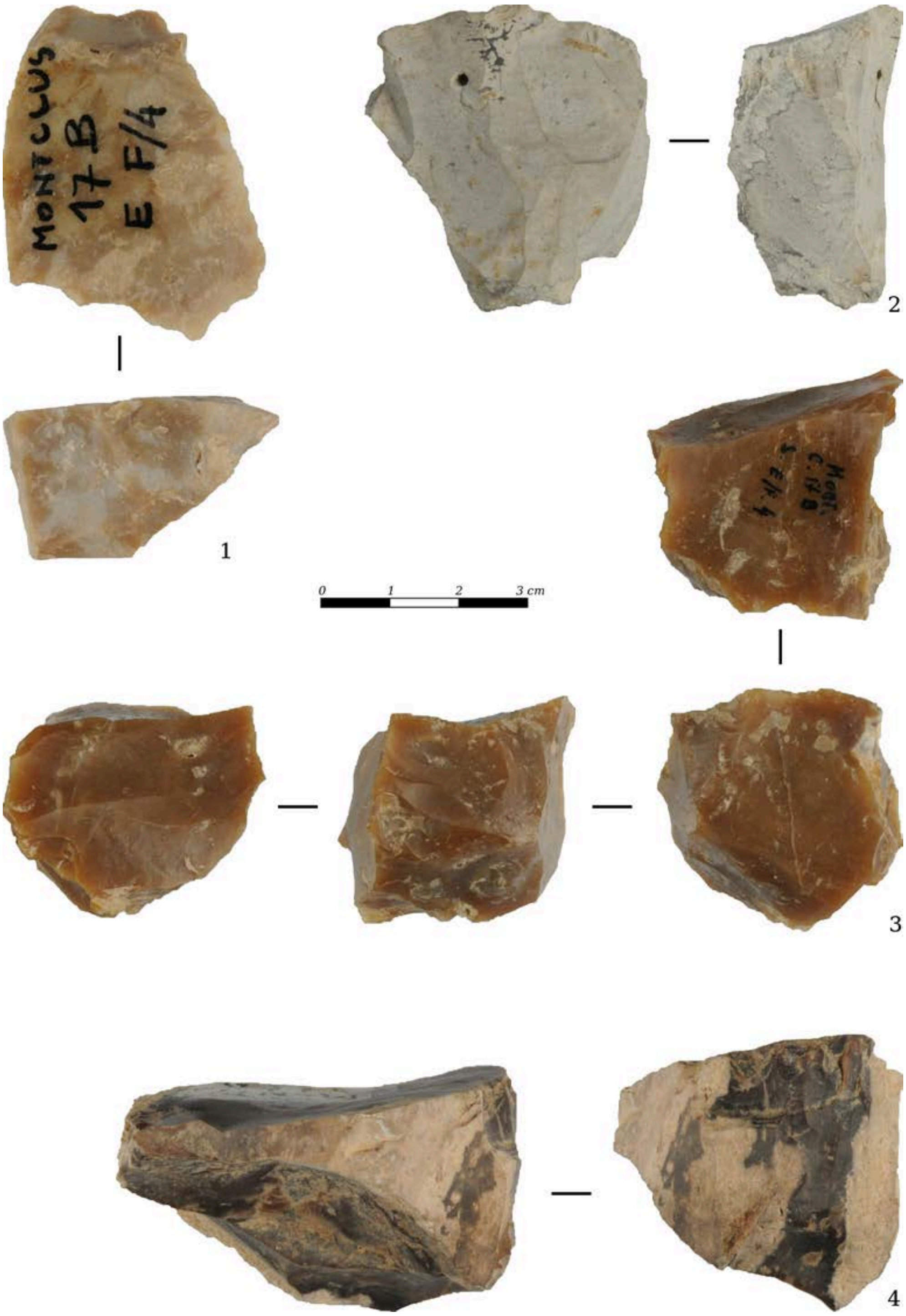

Figure 6.6: Baume de Montclus, L. 17. Lamellar cores on flakes (endscraper-like) (1, 4), lamellar (2) and flake (3) cores. Core n. 3 attests a previous lamellar exploitation.

rarely two or more platforms and surfaces are attested. Cores were generally flaked with a *semi-tournant* rhythm and more rarely with a *tournant* one. Other modalities include large and narrow frontal exploitations as well as on-edge ones. A third of the cores (26) was realized on large flakes that were exploited with frontal or semi-tournant direct removals, generally localised in their distal part (endscraper-like) or as burin-like cores. In two endscraper-like cores belonging to layer 19 and three to layer 21 the striking platform and the debitage surface were inverted, the former being located on the dorsal side of the blank. These cores could actually be seen has an intermediate type between the two most common ones. In some cases a regular endscraper-like exploitation is followed by an inverse one. The other cores are represented by prismatic, polyhedral (resulting from multiple reorientations of the cores) and, more rarely, pyramidal cores. Among them two cores realized on small flattish slabs present a sort of crest (cf. *supra*).

Table 6.11: Baume de Montclus, l. 22-17. Number and relative position of debitage surfaces.

	L. 22		L. 21		L. 20		L. 19		L. 18		L. 17	
One	8	61.5%	12	42.9%	10	71.4%	5	62.5%	11	84.6%	5	83.3%
Two consecutive	5	38.5%	9	32.1%	1	7.1%	1	12.5%	1	7.7%		
Two opposite			4	14.3%	3	21.4%	1	12.5%				
Three or more			3	10.7%			1	12.5%	1	7.7%	1	16.7%
Total	13	100%	28	100%	14	100%	8	100%	13	100%	6	100%

Table 6.12: Baume de Montclus, l. 22-17. Number and relative position of striking platforms (ds = debitage surface).

	L. 22		L. 21		L. 20		L. 19		L. 18		L. 17	
One	9	69.2%	13	46.4%	10	71.4%	4	50.0%	9	69.2%	4	66.7%
One +1 peripheric			1	3.6%					1	7.7%		
One +1 secondary	1	7.7%	2	7.1%			1	12.5%				
Two opposites - same ds					1	7.1%			2	15.4%		
Two opposites - diff. ds			1	3.6%	1	7.1%						
Two orthogonal - same ds			1	3.6%								
Two orthogonal - diff. ds	2	15.4%	5	17.9%	1	7.1%	2	25.0%			1	16.7%
Two orthogonal +1					1	7.1%						
One peripheric			2	7.1%								
Three	1	7.7%					1	12.5%				
More than three			3	10.7%					1	7.7%	1	16.7%
Total	13	100%	28	100%	14	100%	8	100%	13	100%	6	100%

Most cores were abandoned in the middle of the production phase and do not show any major technical features that would have prevented the continuation of the flaking process. Only in rare cases (4) they were either extremely reduced or over-exploited. In others, the causes of abandonment were represented either by raw material irregularities or, more frequently, by hinged removals. The generally low exploitation rate of the cores could be connected with the relatively high presence of cherty raw materials in the surrounding of the site. Objectives of the production vary from blade-oriented cores to flake-oriented and mixed ones. There seem not to be any specific correlation between the aim of production and core types but for burin-like and straight frontal cores that, because of their morphology, are preferentially oriented towards the production of lamellar blanks.

6.5 Blanks selection and transformation

6.5.1 Microlithic armatures

Table 6.13: Baume de Montclus, l. 22-17. Blanks selected for the production of microlithic armatures.

	L. 22		L. 21		L. 20		L. 19		L. 18		L. 17	
Blades/bladelets	1	25.0%	17	31.5%	18	64.3%	14	53.8%	34	51.5%	80	87.9%
Bladelets/flakes	3	75.0%	36	66.7%	8	28.6%	9	34.6%	31	47.0%	9	9.9%
Flakes					2	7.1%	2	7.7%				
Cortical backed bl.							1	3.8%				
Semi-cortical bl.			1	1.9%					1	1.5%	2	2.2%
Total	4	100%	54	100%	28	100%	26	100%	65	100%	91	100%

The analysis of blanks selected for the production of microlithic armatures indicates a preference for lamellar blanks, a tendency that is particularly marked in the most recent layers (Table 6.13). In the earliest ones, on the other hand, it was not possible to ascertain the exact nature of the blank for the majority of the microliths. Along with *plein débitage* bladelets, also semi-cortical and backed ones were selected as testified by a few elements. Their number could be underestimated due to the modifications induced by retouch.

At a general level blanks were accurately selected on the base of their morphology in order to minimize the transformation effort. Retouch was realized by pressure, as indicated by the regularity of removals and the angle obtained that is generally inferior to 90°. In some cases direct and inverse retouches were combined in order to obtain a right angle. Additionally a complementary either simple or abrupt retouch was realized by grinding in order to regularize the natural edges if a double back was not shaped out. The use of the microburin technique is not attested. The only exceptions are represented by one trapeze and one triangle featuring a *piquant-trièdre* and a proximal microburin, all coming from layer 18. Considering this ephemeral occurrence it is possible that their presence is either accidental or the result of some stratigraphic mixing.

From a typological point of view the microlith assemblage is quite standardized (Table 6.14; Figure 6.7) and composed of very few types along with numerous fragments.

Backed points are all small sized with length and width ranges respectively of 10-14 mm and 2-6 mm. All the entire or incomplete specimens are natural based points (8) featuring a large unretouched base that generally corresponds to the distal part of the blank and can either be hinged or feathered. Only one of them is not a proximal point. In five cases the tip was only roughly shaped out and in three artefacts a double back is attested. Two among the fragments that could be attributed to backed points - belonging to layer 17 and 18 - seem to correspond to typical elongated Sauveterre points (both of them are more than 10 mm long, 2 mm wide and 1-2 mm thick) featuring a single backed side and a complementary retouch. The other four elements are represented by simple backed points.

Triangles are all represented by scalene types. One atypical artefact, although only retouched on the small base and on the third side, was assimilated to this category on the basis of its shape and size. Triangles were realized following the debitage axis of the blanks with the small base located either on the proximal or distal part. As seen

Table 6.14: Baume de Montclus, l. 22-17. Microlithic armatures.

	L. 22		L. 21		L. 20		L. 19		L. 18		L. 17	
Backed points	1	25.0%	6	11.1%	1	3.6%	4	15.4%	2	3.0%	1	1.1%
natural base	*1*		*3*		*1*		*4*		*1*			
fragments			*3*						*1*		*1*	
Scalene triangles	1	25.0%	17	31.5%	8	28.6%	10	38.5%	32	48.5%	41	45.1%
Scalene trapezes									1	1.5%		
Backed bladelets											1	1.1%
Backed fragments	2	50.0%	27	50.0%	14	50.0%	10	38.5%	28	42.4%	38	41.8%
backed fr.	*1*		*19*		*8*		*2*		*15*		*11*	
pointed backed fr.			2				3		1			
double backed fr.			3		3		4		9		*19*	
pointed double b. fr.	1		*1*		*2*		*1*		*2*		*6*	
backed-and-trunc. fr.			2		*1*				*1*		*2*	
Under construction			4	7.4%	5	17.9%	2	7.7%	3	4.5%	10	11.0%
Total	4	100%	54	100%	28	100%	26	100%	65	100%	91	100%

for backed points the main tip of the triangles - the one located opposite to the small base - is not always completely shaped out (11.9%). In some cases part of the butt is clearly visible. In others, the distal part of the blank or snap fractures produced during retouch and only partially modified are attested. Five triangles slightly differ being characterized by a right angle between the two bases, the longer of which tends to be convex. Another variable in the assemblage is represented by the delineation of the short base that could either be straight or concave. Some major differences between the levels can be appreciated when looking at the third side (hypotenuse) of the triangles (Table 6.15). While in the earliest levels (21-20) it was mainly regularized through a marginal, simple and generally partial retouch, in the most recent ones the manufacture of a third backed side became dominant (from 23.5% in layer 21 to 68.3% in layer 17).

Table 6.15: Baume de Montclus, l. 22-17. Morphology of the third side of triangles.

	L. 22		L. 21		L. 20		L. 19		L. 18		L. 17	
Backed third side			4	23.5%	3	37.5%	5	50.0%	19	59.4%	28	68.3%
Compl. retouch	1	100.0%	11	64.7%	5	62.5%	5	50.0%	11	34.4%	11	26.8%
Natural third side			2	11.8%					2	6.3%	2	4.9%
Total	1		17		8		10		32		41	
Total	1	100%	17	100%	8	100%	10	100%	32	100%	41	100%

Similarly the dimension of triangles shows an increasing trend when moving from the earliest to the later levels. In Table 6.16 the main dimensional values are reported. While minimum values are exactly the same in the two phases the maximum ones differ significantly. This difference does not affect the relationship between the three dimensions but exclusively their size. The length/width rate, in fact, does not vary consistently (mean 3.95 - 4.07; min. 2.33; max. 6.33 - 6.5).

A single scalene trapeze is attested in layer 18. It was manufactured on an irregular bladelet with a trapezoidal section by using the microburin technique. It is thus highly probable that it actually belongs to the later occupation phases of the site.

Backed fragments are quite numerous (Table 6.14) in all the layers. The most represented group is that of unilateral backed fragments followed by double backed

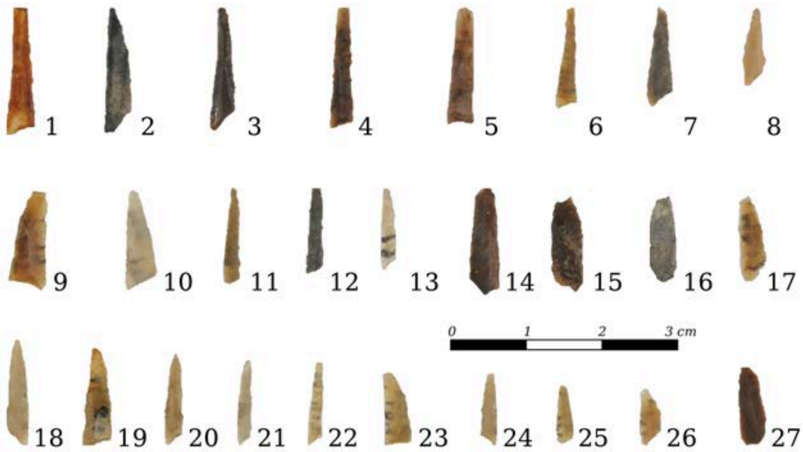

Figure 6.7: Baume de Montclus, L. 21, 19, 17. Microlithic armatures: 1-8. scalene triangles (layer 17); 9-13. scalene triangles (layer 19); 14-17, backed points with natural base (layer 19); 18-26, scalene triangles (layer 21); 27, backed point with natural base (layer 21).

Table 6.16: Baume de Montclus, l. 21-17. Dimensional values of triangles regrouped in two phases.

	L. 22-19				L. 18-17			
	Length	Width	Thickness	L/W ratio	Length	Width	Thickness	L/W ratio
Min.	7	2	1	2.33	7	2	1	2.33
1st Qu.	10	2	1	2.9	11	3	1	3
Median	11	3	1	4	12	3	1	4
Mean	10.89	2.89	1.06	4.07	12.68	3.33	1.22	3.95
3rd Qu.	13	4	1	5.13	15	4	1	4.5
Max.	14	5	2	6.50	23	6	2	6.33
σ	2.04	0.95	0.23	1.29	3.55	0.65	0.42	1.07
Count	28	36	36	28	41	73	73	41

fragments. The latter are particularly abundant in layer 17 and 18. Most of these fragments, as well as backed-and-truncated ones, are probably to be considered as fragmented triangles. Point-terminating fragments - with single or double back - are evenly distributed in all the layers.

Lastly a small number of unfinished artefacts attests the on-site production of microlithic armatures.

6.5.2 Retouched tools

As far as retouched tools are concerned, blanks selection was much more varied than it was for microliths (Table 6.17). Most blanks belong to the main production categories. Blades/bladelets, laminar flakes and flakes represent around half of the transformed blanks. The others are represented by laminar and flake by-products - both semi-cortical and naturally backed. Maintenance elements were seldom used as testified by two surface maintenance flakes.

At a general level retouched tools are not abundant and only layer 17 and 21

Table 6.17: Baume de Montclus, l. 22-17. Blanks selected for the manufacture of retouched tools.

	L. 22		L. 21		L. 20		L. 19		L. 18		L. 17	
Blades/bladelets			4	19.0%	1	20.0%	1	50.0%	3	50.0%	7	30.4%
Laminar flakes			1	4.8%	2	40.0%			2	33.3%	2	8.7%
Flakes			3	14.3%					1	16.7%	6	26.1%
Laminar by-products	2	66.7%	7	33.3%	1	20.0%					5	21.7%
Flake by-products			6	28.6%	1	20.0%					2	8.7%
Maintenance flakes							1	50.0%			1	4.3%
Undetermined fr.	1	33.3%										
Total	3	100%	21	100%	5	100%	2	100%	6	100%	23	100%

yielded a significative number (Table 6.18; Figures 6.8; 6.9). The most attested groups are, by far, those of denticulates and notches. These tools were realized on a wide gamma of blanks spanning from main products to semi-cortical and naturally backed blanks, and from bladelets to flakes.

Table 6.18: Baume de Montclus, l. 22-17. Retouched tools.

	L. 22		L. 21		L. 20		L. 19		L. 18		L. 17	
Burins			2	9.5%							2	8.7%
Endscrapers			1	4.8%	1	20.0%					1	4.3%
Truncations			2	9.5%							1	4.3%
Borers	1	33.3%	2	9.5%					1	16.7%		
Backed pieces			1	4.8%			1	50.0%				
Backed fr.	1	33.3%			1	20.0%					1	4.3%
Pointed pieces											2	8.7%
Retouched pieces			3	14.3%	2	40.0%			2	33.3%	3	13.0%
Retouched fr.			1	4.8%								
Denticulates			4	19.0%			1	50.0%	1	16.7%	8	34.8%
Notches			3	14.3%	1	20.0%			1	16.7%	3	13.0%
Composite tools	1	33.3%	2	9.5%					1	16.7%	2	8.7%
Total	3	100%	21	100%	5	100%	2	100%	6	100%	23	100%

As regards the former group it is composed of tools featuring one or more denticulated edges shaped out by means of simple or semi-abrupt retouches. The denticulated retouch generally interests the lateral side of the blanks although composite tools in which more than one side was modified are also attested (4). In addition, in layer 21, a denticulated, short endscraper was identified. Two artefacts belonging to layer 17 differentiate significantly from the above described assemblage. They are represented by denticulated, slightly pointed tools featuring a bilateral semi-abrupt retouch carefully obtained through distinct unilateral strikes that allowed the preservation of a good cutting edge. Single isolated notches were shaped out through simple (5) or abrupt (3), direct (3) or indirect (5) retouch. Selected blanks are mostly represented by lamellar blanks but for one flake and two semi-cortical flakes.

Burins were mostly realized on semi-cortical by-products and maintenance flakes (3). Only one, partially destroyed by thermal alteration, was manufactured on a thick blade (67 x 25 x 10 mm). Two of them are simple burins, one a dihedral burin and the latter a double burin. The three endscrapers were realized on flakes and semi-cortical flakes. One of them is characterized by the presence of lateral retouches. Truncations

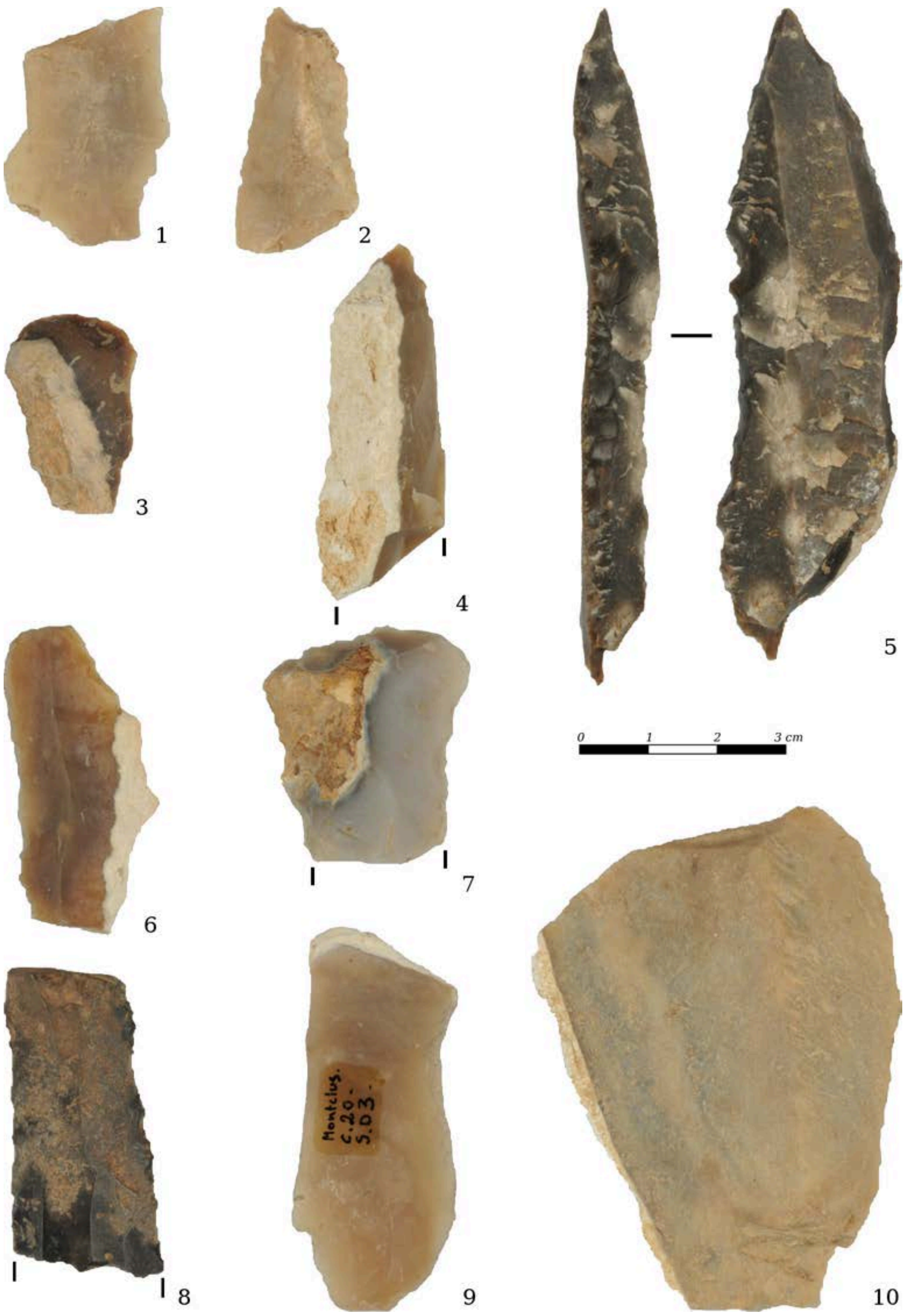

Figure 6.8: Baume de Montclus, L. 21-17. Retouched tools: 1-2, truncations; 3. endscraper; 4-5, pointed pieces; 6-10, retouched pieces.

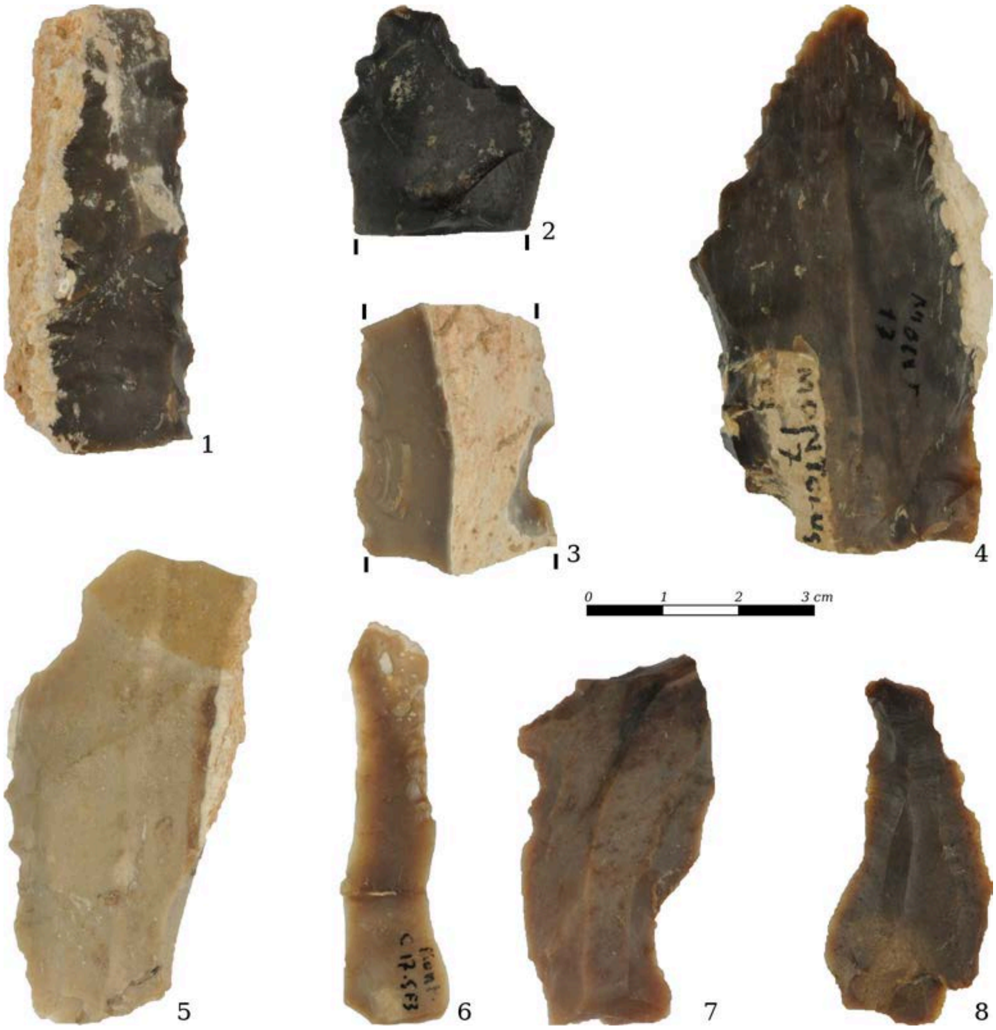

Figure 6.9: Baume de Montclus, L. 22-17. Denticulated retouched tools.

were manufactured on the distal end of two bladelets and a laminar flake. The former two feature a deep, oblique abrupt retouch while the latter is characterised by a partial and marginal transversal retouch. As for borers they were realized on products and by-products selected because of their natural morphology. Three of them, in fact, were manufactured with marginal retouches aimed at the regularization and strengthening of the active zone. In two of them retouch is bilateral and alternate. The latter was obtained with a single transversal blow and some minor removals. Backed pieces are only represented by one flake with a slightly denticulated marked retouch and one bladelet with a lateral marginal retouch. Moreover two additional laminar fragments with a marginal abrupt retouch and one retouched undetermined fragment are also attested.

Two pointed pieces, both belonging to layer 17, were manufactured on large on-edge semi-cortical blades. One is 90 mm long while the other is fragmentary but it is supposed to have been of a similar size. On the former the retouch does not only interest the tip of the tool but continues on the two sides with more or less regular removals. The blank, at the time of its transformation, had already undergone thermal alterations as indicated by the presence of a greasy gloss on the negatives of the retouches.

Pieces with semi-abrupt retouches are relatively abundant. Blanks are represented by blades, flakes and naturally backed blades and flakes. Retouch is generally direct (7 out of 10), marginal (5) or marked (5) and with a straight delineation. In two cases it forms a convex edge. One of the laminar retouched pieces was actually modified on both the sides of the tool (layer 17).

Six composite tools are present in the assemblages. These are represented by two elements in which a denticulated edge is associated to a notch, two with a denticulated and a semi-abrupt retouched edge, one featuring a denticulated edge and a burin and a semi-abrupt retouched edge associated to a borer.

6.6 Use and wear

Use-wear analysis was extensively conducted only on the lithic assemblage belonging to layer 17. It involved all the retouched artefacts (91 microlithic armatures and 23 retouched tools) and a sample of 462 unmodified blanks selected because of their preservation state and size among all the classes of artefacts. Heavily burnt artefacts, blanks and fragments smaller than 1.5 cm were generally excluded. For the other Early Mesolithic layers only the microlith assemblages were analysed.

The preservation state of the assemblage appeared in general quite poor although with great differences between the artefacts. Most of them were characterized by taphonomic alterations affecting both edges and surfaces that combined to the high rate of thermal alteration led to a difficult analysis and interpretation of the record. Taphonomic microchipping, that partially destroyed possible active edges, is mostly to be correlated to excavation activities and storage conditions. These processes also led to numerous surface alterations visible at high magnifications such as micro-striations and bright-spots. Due to the poor preservation state in most cases the interpretation of worked materials was limited to general hardness classes.

All the artefacts selected for the analysis were cleaned with warm water and soap. Many of them were covered by thick layers of varnish that were removed by washing and rubbing with cotton and acetone.

6.6.1 Unretouched tools

Among the 462 unretouched artefacts only a small percentage (5.19%) revealed the presence of use-wear or possible use-wear traces. These are mostly represented by laminar/lamellar and flake products and by-products as reported in Table 6.19.

Table 6.19: Baume de Montclus, l. 17. Unmodified blanks used as tools.

Blades/bladelets	5	26.3%
Naturally backed blades/bladelets	1	5.3%
Cortical backed blades/bladelets	5	26.3%
Semi-cortical blades/bladelets	3	15.8%
Laminar flakes	1	5.3%
Flakes	4	21.1%
Naturally backed flakes	1	5.3%
Cortical backed flakes	1	5.3%
Semi-cortical flakes	3	15.8%
Total	24	100%

A total of 27 active zones were identified (Figure 6.10). Five of them correspond to longitudinal actions, mostly carried out on soft materials (Table 6.20). In one case it could be ascertained that use-wear was the result of butchery. Four of these artefacts correspond to lamellar blanks, two bladelets and two backed blades, while the fifth one is a flake. All the blanks feature convex or sinuous edges with angles comprised between 30° and 15° except for the semi-cortical blade that is supposed to have worked a mid-hard material and that features a 45° angle.

Table 6.20: Baume de Montclus, l. 17. Active zones classified according to worked material hardness and motion. Between brackets the number of possible active zones.

	Longitudinal	Transversal	Rotational	Total
Hard		6 (3)		6
Mid-hard	1 (1)	5 (4)		6
Mid-soft		2 (2)		2
Soft	4 (2)			4
Mineral		6		6
Undetermined		2 (2)	1	3
Total	5	21	1	27

Transversal actions (n. 21) are by far more numerous than longitudinal ones. They were mostly carried out on hard or mid-hard materials. Straight and convex edges belonging to a wide variety of blanks were used with this motion. Angles are quite varied too, spanning between 20° and 65°. A semi-cortical flake with a 45° straight edge and a semi-cortical bladelet with a 50° concave edge were probably used for working wood as testified by the regular, unidirectional scarring, with large semicircular and quadrangular removals. Six active zones correspond to the scraping of a mineral colouring material or of a mid-hard material covered with powder as testified by colouring residues on the edges (Figure 6.11; cf. Figure 6.12). Used edges are all straight or slightly convex but with very different angles. Three of them, featuring

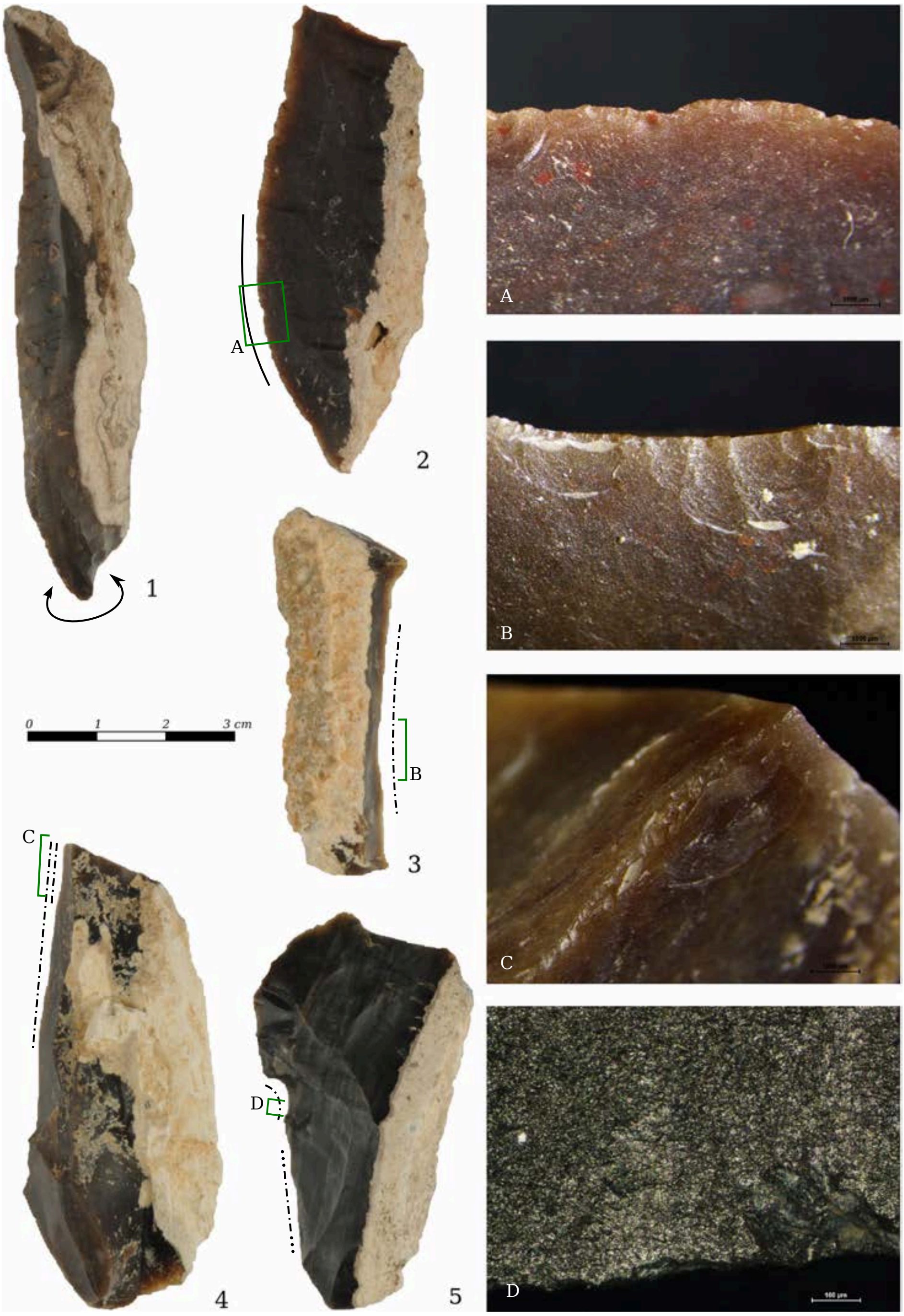

Figure 6.10: Baume de Montclus, l. 17. Unretouched tools featuring use-wear traces: 1, semi-cortical blade used as borer; 2, cortical naturally backed blade used to cut a soft material; 3, cortical naturally backed blade used to scrape a mid-hard material; 4, thick cortical naturally backed blade used to scrape a hard material; 5, cortical naturally backed flake used to scrape a mid-hard material (photos A-C taken at 10X; D at 100X).

angles spanning between 60° and 40° were used unidirectionally, with a wide working angle. The activity caused a very well developed asymmetric rounding of the edge and the removal of medium-small feather-terminating scars. One of these blanks presents a second active zone in correspondence of the dihedral created by the intersection of the butt with one of the dorsal facets. The two other tools were used with a slightly different cinematic. The working angle was probably sharper and the material softer. Both edges, in fact, yielded a metallic polish, similar to the one present on the other three tools, but very marginal, associated to a slightly asymmetric, well developed rounding and very small unidirectional round removals.

Finally the proximal end of a semi-cortical blade was used as a borer with a bidirectional rotating movement (Figure 6.10, 1).

6.6.2 Retouched tools

Twelve retouched tools yielded use-wear traces (Table 6.21; Figure 6.13, 6.14). Most of them are characterized by notches or denticulated retouches along with 1 truncated flake, 2 pointed pieces, 1 retouched piece and 1 composite tool - associating a borer to a semi-abrupt retouched edge. Some of them yielded more than one active zone for a total of 17 used edges.

Table 6.21: Baume de Montclus, l. 17. Retouched tools featuring use-wear traces. Percentage refers to the category totals.

	u-w/tot.	Relative %
Truncations	1/3	33.3%
Pointed pieces	2/2	100.0%
Retouched pieces	1/10	10.0%
Denticulates	4/14	28.6%
Notches	3/8	37.5%
Composite tools	1/6	16.7%
Total	12/60	20.0%

The truncated laminar flake was used on the right natural edge characterized by a concave delineation. The presence of direct feather or hinge terminating semicircular or trapezoidal removals suggests a transverse, or rather oblique, motion on a mid-hard material.

The two pointed pieces, manufactured on large semi-cortical blades, were used on the shaped out tips as borers, with a rotational movement. Worked material is uncertain: in one case it is likely that two active zones corresponding to the opposite tips of the tool were used on a soft material, while in the other a mid-hard one.

On the two retouched edges of a blade, two active zones were identified. The first one, characterized by a direct retouch, is only partially preserved due to the ancient breakage of the proximal end of the tool. The other one was shaped out at a later stage with an inverse retouch that partially covered the fracture. The heavy alteration did not allow to determine the worked material although for both edges a transversal action can be proposed.

A denticulated point presents a good symmetrical rounding on the retouched edges associated to a bright domed and patchy polish that suggests its use with a longitudinal motion. Unfortunately it was not possible to determine the nature of the

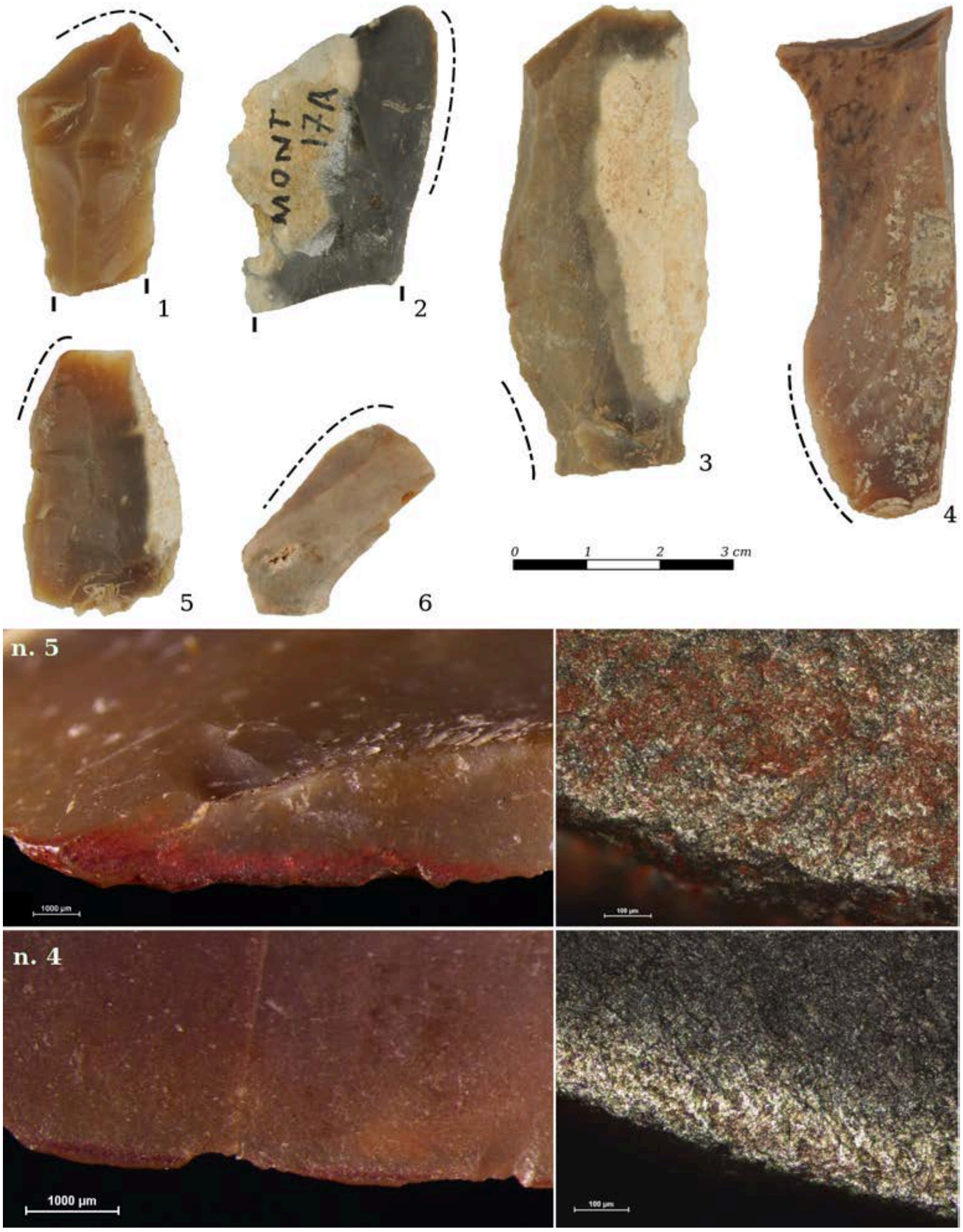

Figure 6.11: Baume de Montclus, l. 17. Artefacts used for scraping a colouring material or a coloured hard material. Microscopic details of the use-wear yielded by artefacts 5 and 4. Photos taken at 10X (left) and 100X (right). The edges are very well rounded and the polish has a hard, metallic aspect and presents a transversal development.

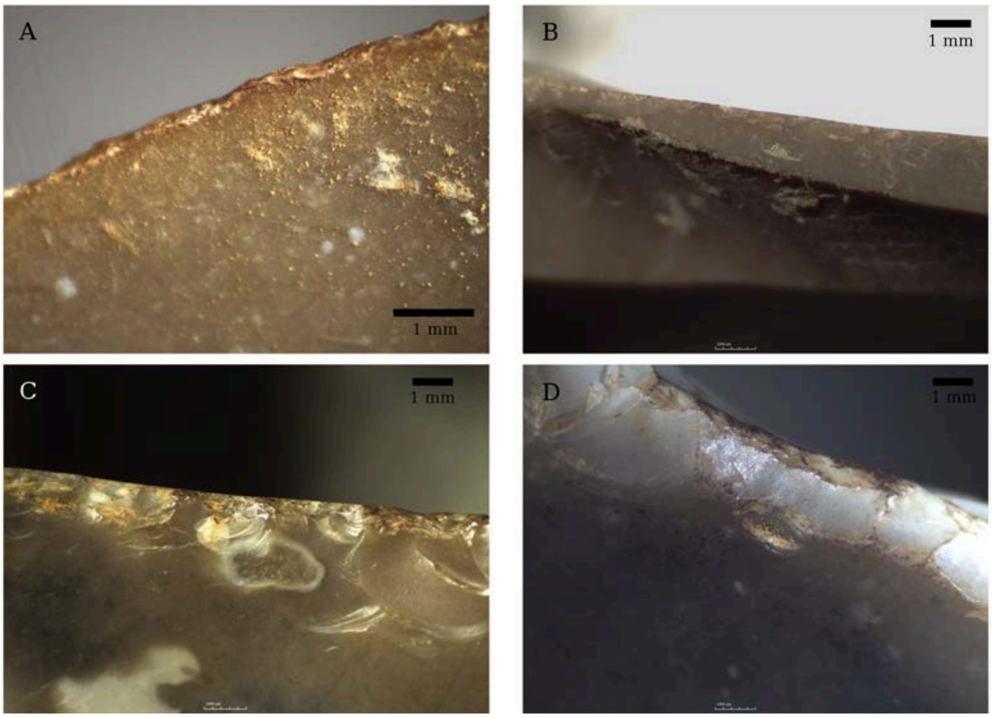

Figure 6.12: Experimental artefacts used for scraping soft (A, B; 6 min.) and hard (C, D; 2 min.) ochre slabs. Figure A shows the area of accumulation of the ochre powder on the leading surface; figures B and C the different size and morphology of the removals with respect to the material hardness; D shows the rapid formation of edge rounding when edge scarring does not take place.

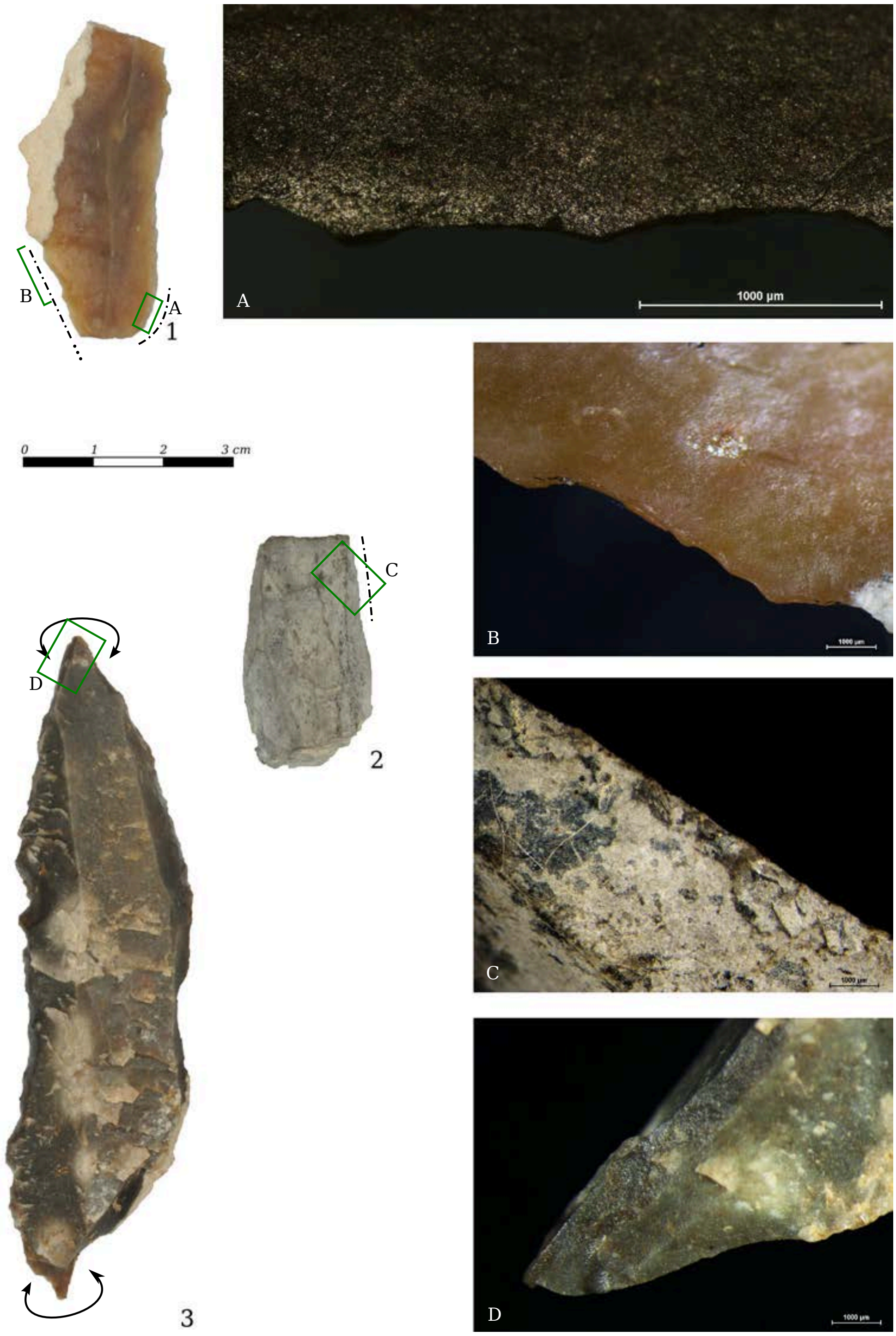

Figure 6.13: Baume de Montclus, l. 17. Retouched tools featuring use-wear traces: 1-2, retouched blade and truncated flake used transversally on mid-hard materials; 3, double pointed piece used with a rotational movement on a soft material.

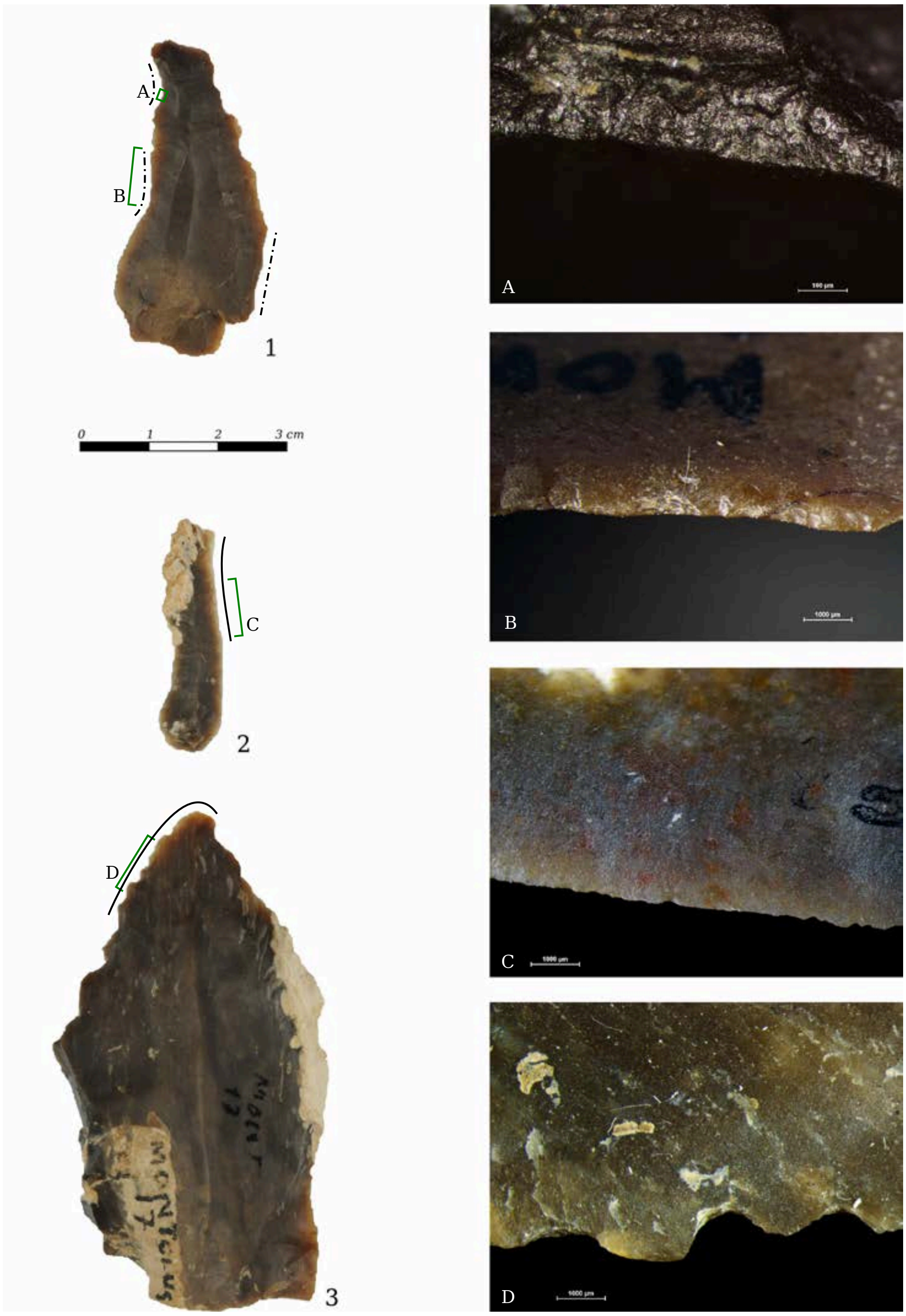

Figure 6.14: Baume de Montclus, l. 17. Retouched tools featuring use-wear traces: 1, denticulated laminar flake used for scraping hard materials; 2, notched bladelet whose natural edge was used to cut a soft material; 3, denticulated piece with possible use-wear related to a longitudinal motion on an undetermined material. Photo D highlights the retouch of the denticulated edges (all photos taken at 10X).

worked material. The other denticulated artefacts, on the other hand, feature traces connected to a transversal action. In one case two consecutive notches manufactured on a thick flake form a pointed edge yielding evidence of use. Another semi-cortical flake with a denticulated retouch was actually used on a natural portion of the edge, right next to the modified one, where large, direct, trapezoidal, stepped removals indicate its transversal use. The last one is a bladelet with multiple notches shaped out along its two edges. The tool was used on, at least, three different retouched zones for scraping a hard material. In two of these active zones the presence of a marginal polished bevel suggests the possibility that it could be a hard animal tissue.

The cinematic connected to the utilization of three notched artefacts appears quite complex and varied too. Only in one case, in fact, it was the notch that was used as active edge on a hard or mid-hard material. A small bladelet featuring an irregular flat inverse notch on its left proximal portion was actually used on the opposite edge for cutting soft materials, quite likely in connection to butchery activities. The retouched area, on the other hand, appears fresh, without any traces of use-wear. The third tool is an irregular flake with a shallow notch on its distal transversal edge. Also in this case, it was the natural edge located just next to the retouched one that has been used and the motion is, once again, transversal. Additionally the naturally pointed distal right edge was used as a borer with a rotational movement as testified by the micro-scarring.

A similar pattern was highlighted for a composite tool associating a retouched lateral edge and a borer. While no clear evidence of use is attested in correspondence of the two retouched edges, the natural one localised between the two was used for scraping an abrasive mineral coloring material similarly to the above described unmodified blanks.

6.6.3 Microlithic armatures

The number of artefacts that yielded impact traces is relatively low and comprised between 9.1% and 19.2% of the microliths (Table 6.22).

Impact fractures identified on backed points and the relative fragments are consistent with an axial hafting modality (Figure 6.15). Three of the five specimens are represented by proximal points with natural base. The first one (l. 18), that is hinge terminating, features a *siret*-like longitudinal breakage while the second (l. 19) a step basal fracture associated to a bending hinge terminating apical fracture with a small ventral spin-off. Similarly in the third one (l. 19) a bending apical fracture is associated to a bending transversal fracture. A Sauveterre-like pointed backed fragment features a very long burination (> 5 mm) while the last element is represented by the tip of a backed point with a 3 mm long basal bending fracture.

As regards scalene triangles diagnostic or possibly diagnostic impact traces were identified on 19 artefacts (Figure 6.15, 6.16). Impact fractures are equally distributed on the main pointed end of the microliths (n. 6), in the small one (n. 6) or in both of them (n. 7). Burinations are the more frequent type of impact traces (n. 9) and are mostly located on the small apex. These are followed by composite fractures (n. 7) that, on the other hand, are almost exclusively found on the main one. In light of the high variability of fracture location patterns a multiple hafting modality - as axial arrow tip or as barbelure - can be surmised. One undamaged triangle yielded important ochre residues covering almost its entire surfaces. The presence of the reddish material could be hypothetically connected to the hafting of the microlith (as gripping component) (cf. Cristiani et al., 2009; Lombard, 2007; Wadley, 2005; Zipkin et al., 2014).

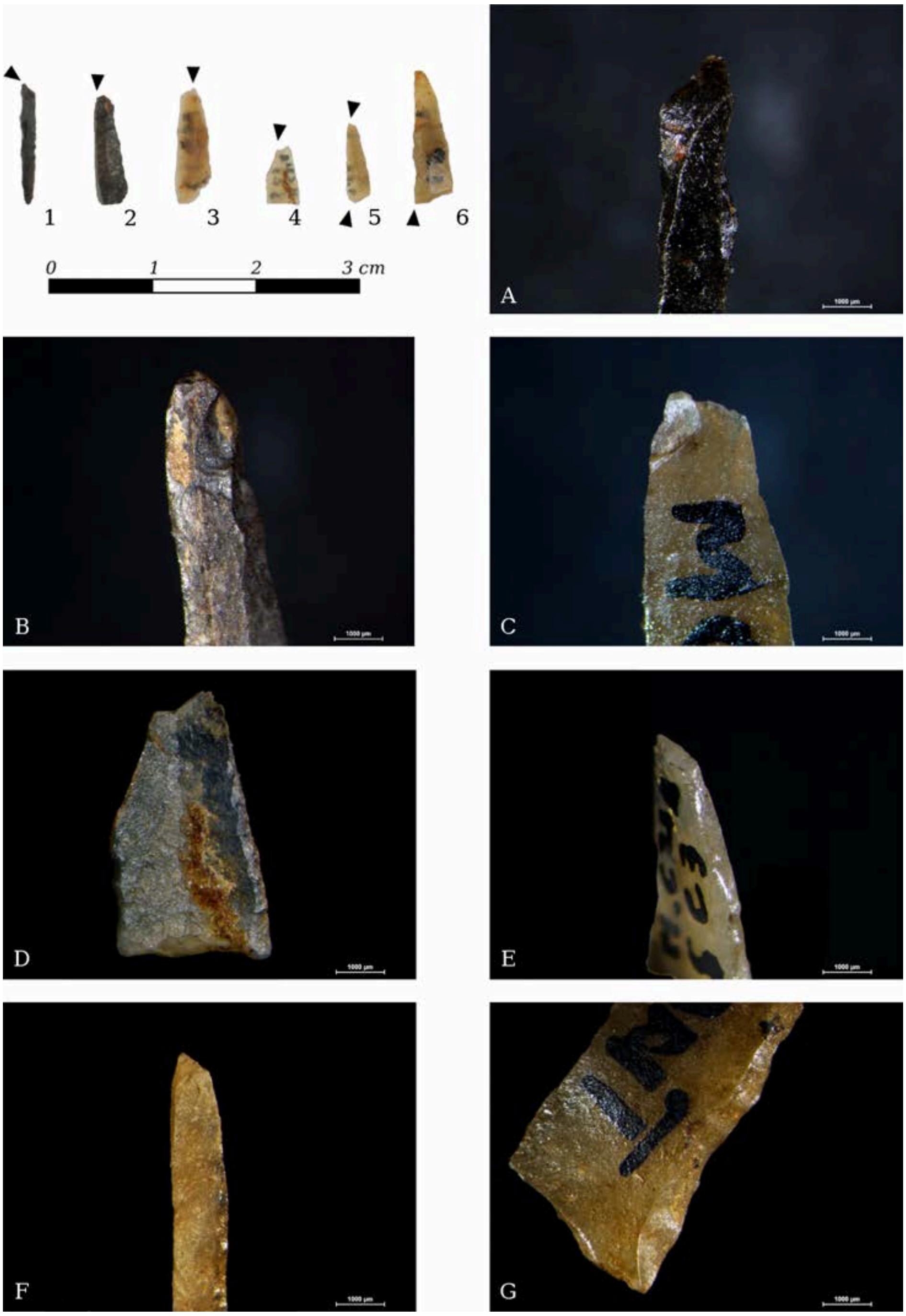

Figure 6.15: Baume de Montclus, l. 21 (4-6), 19 (3) and 18 (1-2). Backed points (1-4) and triangles (5-6) featuring impact traces. A,C,G, burinations (respectively artefacts n. 1, 3 and 6); B, *siret*-like fracture (n. 2); D, particular highlighting the morphology of artefact n. 4; E, snap fracture with burinant spin-off (n. 4); F, long feather terminating bending fracture (n. 5).

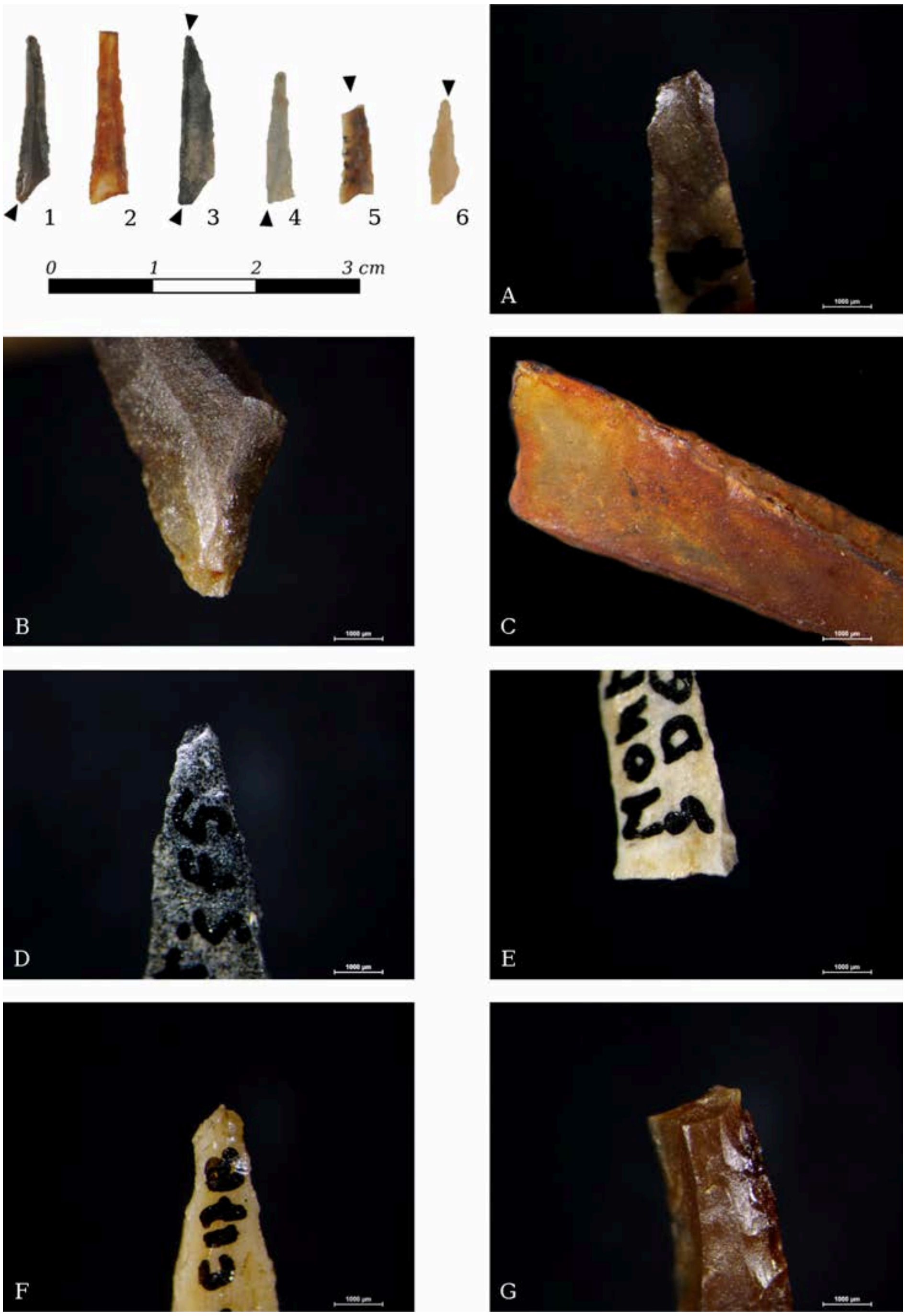

Figure 6.16: Baume de Montclus, l. 17. Scalene triangles with impact or hafting traces: A, particular showing the preservation of the bulb-and-butt area in correspondence of the main apex of artefact n. 1; B, multiple burinant removals (n. 1); C, particular showing the distribution of ochre residues on artefact n. 2; D-F, burinant removals attested respectively on artefacts n. 3, 4 and 6; G, snap fracture with burinant removal (all photos taken at 10X).

Additionally impact fractures were identified on 11 undetermined backed fragments with patterns that are not dissimilar from the ones described for backed points and triangles.

Table 6.22: Baume de Montclus, l. 17. Microlithic armatures that yielded impact traces. Percentage refers to category totals. Between brackets the number of artefacts with possible traces.

	L. 21		L. 20		L. 19		L. 18		L. 17	
	u-w/tot.	%	u-w/tot.	%	u-w/tot.	%	u-w/tot.	%	u-w/tot.	%
Backed p.	0/6	-	0/1	-	2/4	50.0%	2/2	100%	1/1	100%
Triangles	4(1)/17	23.5%	2(1)/8	25.0%	3(2)/10	30.0%	2/32	6.3%	8(2)/41	19.5%
Backed fr.	3(1)/27	11.1%	2(1)/14	14.3%	0/10	-	2(2)/28	7.1%	4/38	10.5%
Total	7(2)/54	13.0%	4(2)/28	14.3%	5(2)/26	19.2%	6(2)/66	9.1%	13(2)/91	14.3%

Chapter 7

Le Mose

Contents

7.1 Site introduction

The archaeological area of Le Mose (Piacenza, Emilia-Romagna), extending over 20,000 square metres, is located near the current confluence of the river Nure and Po, at around 15 km from the Apennine foothills (Fontana et al., 2009b). It was identified during construction works for a warehouse and excavated between 2000 and 2001 under the direction of the Soprintenenza Archeologia dell'Emilia Romagna (M. Bernabò Brea).

The whole area attests a thick sedimentary sequence (150–200 m), the top of which is characterized by palaeo-channel depositional units intercalated by Holocene soils (type entisol and inceptisol). In particular the presence of slightly relieved stratified gravels and gravelly sands testifies the presence of Late Pleistocene alluvial fans. The finer sediments that deposited in the lateral portions of these fans, were eroded by the Pleistocene Apennine streams and large depressions originated from such erosion. Later on fine sediments started to deposit and 2 marshy soils formed. The most recent one lies around 1-2,5 m below the current surface. With a thickness of 20-60 cm, this horizon is characterized by dark brownish, clayish sediments and an undulated surface. Later this soil was partially eroded and covered by sandy deposits.

Within this soil a rich Mesolithic record, consisting of 29 lithic scatters of different size (from 4 to 30 square metres), was identified. All these scatters are consistent with an Early Mesolithic age. Le Mose can, thus, be considered the first extensive Early

Mesolithic settlement in Italy. Northwards, in other sectors of the excavation, Late Mesolithic and Neolithic artefacts were also identified (Bernabò Brea et al., 1998). Two radiometric dates are available for this site (Table 7.1) and, in accordance with the techno-typological attribution, allow dating the settlement phase to the Late Preboreal and Boreal chronozones.

Table 7.1: Le Mose. Available radiocarbon datings.

L. Scatter	Lab. ID	Material	Radiocarbon age	Calib. age BP (2σ)
Pl.19S - SU 507	Poz-13344	Undet.	9220±50	10,514-10,248
VII - SU 507	Poz-13343	Undet.	8250±50	9409-9081 (93.1%) 9053-9033 (2.3%)

During the excavation, unfortunately, it was not possible to spatially position all of the artefacts. These were only referred to the corresponding lithic scatter, thus preventing any attempt to carry out a detailed spatial analysis. Numerous features (pits, charcoal concentrations and holes) with an uncertain relationship to the Mesolithic evidence were also identified (Fontana et al., 2009b).

Palynological analyses highlighted a major change at the beginning of the Boreal (Marchesini et al., 2016). The conifer dominated arboreal cover that characterized the Preboreal drastically reduced (from 57.8% to 15.7%). Deciduous broadleaved woods partially replaced it but also grasslands increased significantly along with humid species testifying the presence of wet environments close-by.

A few bone fragments were also collected, but their study is still ongoing and no preliminary data are available.

The lithic assemblages were the object of previous techno-typological analyses (Palavanchi, 2008; Fontana and Cremona, 2008; Fontana et al., 2009a,b, 2017) that allowed surmising that the smaller scatters corresponded to specialized sites, while in the larger ones a broader spectrum of activities was attested. As regards flaking methods, one single reduction scheme aimed at a lamellar blank production was identified. Typologically the assemblages are rather varied. For some, domestic tools and microlithic armatures are quite balanced, while in others the latter clearly dominate (Fontana et al., 2017).

7.2 Lithic assemblages

The lithic assemblages belonging to four of the identified scatters were integrally analised from a techno-typological point of view and two of them also from a functional perspective. These correspond to the lithic scatters named VII, IX, XIV and Pl. 9 (Table 7.2). This latter was identified during the excavation for the installation of one of the warehouse plinths. The four assemblages all together amount to a total of 2874 artifacts and were selected trying to comprehend, as much as possible, the variability attested by the lithic scatters (size and number of artefacts, microlith/tool ratio, presumed chronology).

The percentage of thermally altered artefacts varies significantly from one assemblage to the other (Table 7.3), although being always higher than 60%. So does the percentage of fragmentary and incomplete artefacts that are particularly attested in the two richest lithic scatters (Table 7.4).

Table 7.2: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Composition of the lithic assemblages.

	VII		IX		XIV		Pl. 9	
Cort. and semi-cor. bl.	27	5.7%	24	2.5%	57	4.6%	10	4.4%
Laminar blanks	33	7.0%	32	3.4%	146	11.9%	5	2.2%
Flake blanks	27	5.7%	32	3.4%	125	10.2%	8	3.5%
Maintenance blanks	15	3.2%	13	1.4%	30	2.4%	4	1.8%
Burin spalls	2	0.4%	4	0.4%	7	0.6%	6	2.7%
Undetermined fr.	271	57.2%	687	72.8%	651	52.9%	144	63.7%
Flakes <1 cm	62	13.1%	119	12.6%	128	10.4%	26	11.5%
Retouched blanks	19	4.0%	19	2.0%	48	3.9%	15	6.6%
Transformation wastes	10	2.1%	11	1.2%	28	2.3%	5	2.2%
Cores	8	1.7%	3	0.3%	10	0.8%	3	1.3%
Total	474	100%	944	100%	1230	100%	226	100%

Table 7.3: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Thermal alteration of the artefacts.

	VII		IX		XIV		Pl. 9	
Unaltered	175	36.9%	103	10.9%	318	25.9%	63	27.9%
Altered	299	63.1%	841	89.1%	912	74.1%	163	72.1%
Total	474	100%	944	100%	1230	100%	226	100%

7.3 Raw material provisioning

As regards lithic raw materials, provisioning took mostly place in alluvial deposits (Table 7.5), a feature reflecting the further position of the site from the Apennine foothills, with respect to the other Emilian sites (cf. Chapters 8 to 11). The collection of slabs and cobbles in secondary deposition contexts located closer to the outcrops, is, nonetheless, attested in all the lithic scatters.

Exploited litologies are varied and mostly represented by well silicified Cretaceous and Jurassic cherts belonging to Apennine formations such as the Maiolica/Calpionella Limestones, Cherty Limestones and Scisti Diasprigni formations (Table 7.6). Along with these main raw materials, the collection and exploition of red radiolarites belonging to the Monte Alpe Cherts Formation is attested by very few pieces. Furthermore, in particular at lithic scatter XIV, silicified siltstones, probably belonging to one of the

Table 7.4: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Integrity of the artefacts entered into the database.

	VII		IX		XIV		Pl. 9	
Entire	69	45.1%	39	27.9%	139	28.8%	24	42.1%
Incomplete	25	16.3%	36	25.7%	112	23.2%	11	19.3%
Fragments	59	38.6%	65	46.4%	231	47.9%	22	38.6%
Total	153	100%	140	100%	482	100%	57	100%

Tertiary formations of the Parma-Piacenza Apennines, were also flaked.

Table 7.5: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Collection context of raw material.

	VII		IX		XIV		Pl. 9	
Outcrop or in proximity	1	0.8%						
Slope deposit	1	0.8%	8	20.0%	14	12.0%	2	4.3%
Alluvial cobble	21	17.5%	17	42.5%	56	47.9%	11	23.9%
Soil	1	0.8%	4	10.0%				
Undetermined	96	80.0%	11	27.5%	47	40.2%	33	71.7%
Total	120	100%	40	100%	117	100%	46	100%

Table 7.6: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Exploited lithologies.

	VII		IX		XIV		Pl. 9	
Palombini Shales	2	1.4%	1	0.7%		0.0%		0.0%
Calpionella Lm./Maiolica Fm.	76	51.7%	31	22.6%	95	21.4%	20	32.3%
Monte Alpe Cherts Fm.	1	0.7%			6	1.4%	4	6.5%
Scisti Diasprigni Fm.	12	8.2%	10	7.3%	124	28.0%	3	4.8%
Cherty Limestone Fm.	10	6.8%	4	2.9%	28	6.3%	3	4.8%
Undet. siltstone	1	0.7%	1	0.7%	33	7.4%	2	3.2%
Undet. lithology	46	31.3%	91	66.4%	190	42.9%	32	51.6%
Total	148	100%	138	100%	476	100%	64	100%

7.4 Reduction schemes

The technological analysis of the 4 assemblages allowed reconstructing a single main reduction scheme that was adopted for the processing of all the lithic raw materials. Although with minor differences the aim of production was the obtention of small bladelets and flakes (Table 7.7).

7.4.1 Initialisation

For the initialisation of debitage the natural morphology of collected slabs and cobbles was exploited and in particular natural ridges. Generally, the removal of cortical flakes allowed creating a striking platform from which naturally crested or opening blades/flakes were detached (Table 7.8). Less frequently natural fractures were used as striking platforms. One unidirectional crested blade and one partially crested blade attest the occasional and partial shaping out of cores, probably aimed at correcting minor irregularities of block morphologies.

7.4.2 Production

In all the four lithic scatters, the main products are represented by bladelets, laminar flakes and flakes. Laminar and flake by-products are less frequent. Lamellar products

Table 7.7: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Products and by-products.

	VII		IX		XIV		Pl. 9	
Main products	**41**	**56.2%**	**41**	**53.2%**	**203**	**64.9%**	**9**	**40.9%**
Blades	15	36.6%	17	41.5%	78	38.4%	2	22.2%
Laminar flakes	6	14.6%	5	12.2%	28	13.8%	2	22.2%
Flakes	20	48.8%	19	46.3%	97	47.8%	5	55.6%
Laminar by-products	**17**	**23.3%**	**15**	**19.5%**	**61**	**19.5%**	**4**	**18.2%**
Semi-cortical blades	5	29.4%	5	33.3%	20	32.8%	3	75.0%
Semi-cort. on the edge bl.					1	1.6%		
Naturally backed blades	11	64.7%	8	53.3%	24	39.3%	1	25.0%
Cortical nat. backed bl.	1	5.9%	2	13.3%	16	26.2%		
Flake by-products	**15**	**20.5%**	**21**	**27.3%**	**49**	**15.7%**	**9**	**40.9%**
Semi-cortical flake	8	53.3%	8	38.1%	21	42.9%	6	66.7%
Naturally backed flakes	6	40.0%	9	42.9%	18	36.7%	2	22.2%
Cortical nat. backed fl.	1	6.7%	4	19.0%	10	20.4%	1	11.1%
Total	73	100%	77	100%	313	100%	22	100%

Table 7.8: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Initialisation blanks.

	VII		IX		XIV		Pl. 9	
Crested blades	1	7.7%						
Partially crested blades					1	6.7%		
Opening blades			1	9.1%	3	20.0%		
Naturally crested blades	2	15.4%	3	27.3%	3	20.0%	1	100.0%
Opening flakes	1	7.7%	1	9.1%	1	6.7%		
Generic cortical flakes	9	69.2%	6	54.5%	7	46.7%		
Total	13	100%	11	100%	15	100%	1	100%

and by-products are characterized by reduced dimensions, in particular as regards lithic scatter VII and IX where they are shorter than 30 mm (Table 7.9 and Figure 7.1). Assemblage named XIV, on the other hand, yielded a few bladelets and laminar by-products (semi-cortical, cortical or naturally backed bladelets) 41 to 49 mm long. Plinth 9 was excluded from dimensional analysis because of its low number of products, although presenting ranges similar to those of the two former scatters. Bladelets are mostly triangular in cross-section. Only scatter IX presents a significant share of trapezoidal section bladelets (35.3%). Flakes are averagely a few millimeters shorter.

Products were obtained through unidirectional series of removals. Bidirectional scars are well attested only in the assemblages of scatter VII and XIV (between 7.5% and 18%). These pieces are mainly characterized by length values higher than 25 mm, suggesting that bidirectional exploitation took place only during an early exploitation stage. Later it became unidirectional. Furthermore some blanks, in particular flakes, present orthogonal removals indicating reorientations of the cores. These are well testified also by a few reorientation blades and flakes (Table 7.10) that were mostly detached by exploiting the striking platform overhang as a guiding ridge.

Table 7.9: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Summary of the metric values of debitage products and by-products (A = blades, B = laminar by-products, C = flakes, D = flake by-products).

		VII				IX				XIV			
		A	B	C	D	A	B	C	D	A	B	C	D
Length	Min.	13	17	10	10	14	15	12	11	11	14	10	12
	1st Qu.	18	19.25	13.75	13	14.75	21	13	16	16	19	12	15.5
	Median	23	20	15.5	16	18	24.5	15	19	20	25	13	18
	Mean	21.15	19.75	15.44	16.07	19.13	23	16.5	19.63	21.71	27.21	15	20.28
	3rd Qu.	25	20.5	17.25	16.75	22	26.5	17	23	26	31	16	25
	Max.	29	22	22	27	30	28	28	32	43	49	36	35
	SD	5.15	2.06	3.52	5.03	5.54	5.72	5.27	5.18	7.77	11.16	5.32	6
	Count	13	4	16	14	8	4	12	16	41	19	65	39
Width	Min.	5	4	7	8	4	5	7	8	2	5	5	7
	1st Qu.	7	7	8.75	12	6.25	8.5	12.5	12.75	6	7	10	13
	Median	8	8	11.5	16	9.5	10	15	15.5	9	10	11	16
	Mean	8.33	9	12.15	16.86	9.45	9.8	15.05	18.05	9.34	10.43	12.19	15.94
	3rd Qu.	10	11	14.5	21.5	10.75	11.5	16.5	20.5	12	13	14	19
	Max.	16	15	23	30	19	13	27	55	20	23	29	25
	SD	2.65	3.34	4.63	6.89	3.53	2.27	4.18	10.21	4.16	3.84	4.67	4.77
	Count	21	17	20	14	22	15	19	20	103	60	95	49
Thickness	Min.	1	1	1	2	1	1	1	2	1	1	1	2
	1st Qu.	2	2	1	3	2	2.5	2	3	1	2	2	2
	Median	2	3	2	4	2	3	3	3	2	3	2	3
	Mean	2.48	3.29	2.8	5	2.5	3.27	3.42	3.71	2.26	3.69	2.4	3.94
	3rd Qu.	3	4	3	6	3	4	3.5	4	3	5	3	5
	Max.	5	8	11	12	5	8	13	7	6	12	9	15
	SD	1.08	1.79	2.31	2.95	0.96	1.58	2.71	1.35	1.13	1.86	1.38	2.29
	Count	21	17	20	15	22	15	19	21	105	61	96	49

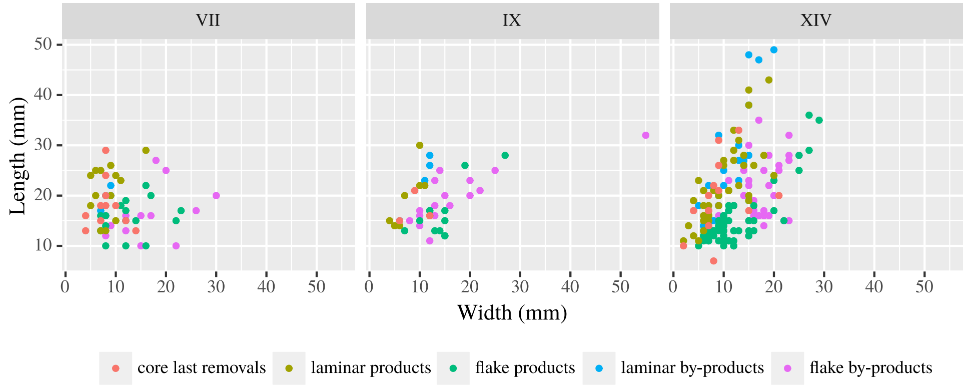

Figure 7.1: Scatterplot of length and width values of products, by-products and core last removals.

Surface maintenance was mostly embedded and achieved removing lamellar or flake blanks from the same striking platform used for debitage. The use of an opposite striking platform is attested only at site IX. Seldomly longitudinal and transversal convexities could be adjusted also with orthogonal removals aimed at creating (partially) neo-cresed blades. The assemblage of lithic scatter XIV, furthermore, is the only one to provide evidence of the maintenance of the striking platforms as demonstrated by the presence of *tablettes* and striking platform maintenance flakes.

Table 7.10: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Maintenance blanks.

	VII		IX		XIV		Pl. 9	
Neo-crested blades			2	15.4%	1	3.3%		
Partially neo-crested blades	2	13.3%			5	16.7%		
Proximal reorientation blades	1	6.7%	3	23.1%	3	10.0%		
Reorientation flakes	3	20.0%	1	7.7%	3	10.0%	2	50.0%
Surface maintenance blades	2	13.3%	1	7.7%	1	3.3%		
Nat. backed surface maint. bl.	1	6.7%	3	23.1%				
Surface maintenance flakes	3	20.0%	1	7.7%	8	26.7%	1	25.0%
Maint. flakes from opposite st. pl.			1	7.7%				
Tablettes					2	6.7%		
Striking pl. maintenance fl.					3	10.0%		
Generic maintenance flakes	3	20.0%	1	7.7%	4	13.3%	1	25.0%
Total	15	100%	13	100%	30	100%	4	100%

7.4.3 Cores

Cores are relatively numerous only in two of the four analysed lithic scatters: VII and XIV. All of them confirm the multiple purpose of the flaking process although the lamellar production appears as the most important one on a numerical basis (Table 7.11; Figure 7.2).

Most cores feature a single main striking platform that was used to exploit a single debitage surface (Tables 7.12 and 7.13). More rarely two opposite striking platforms

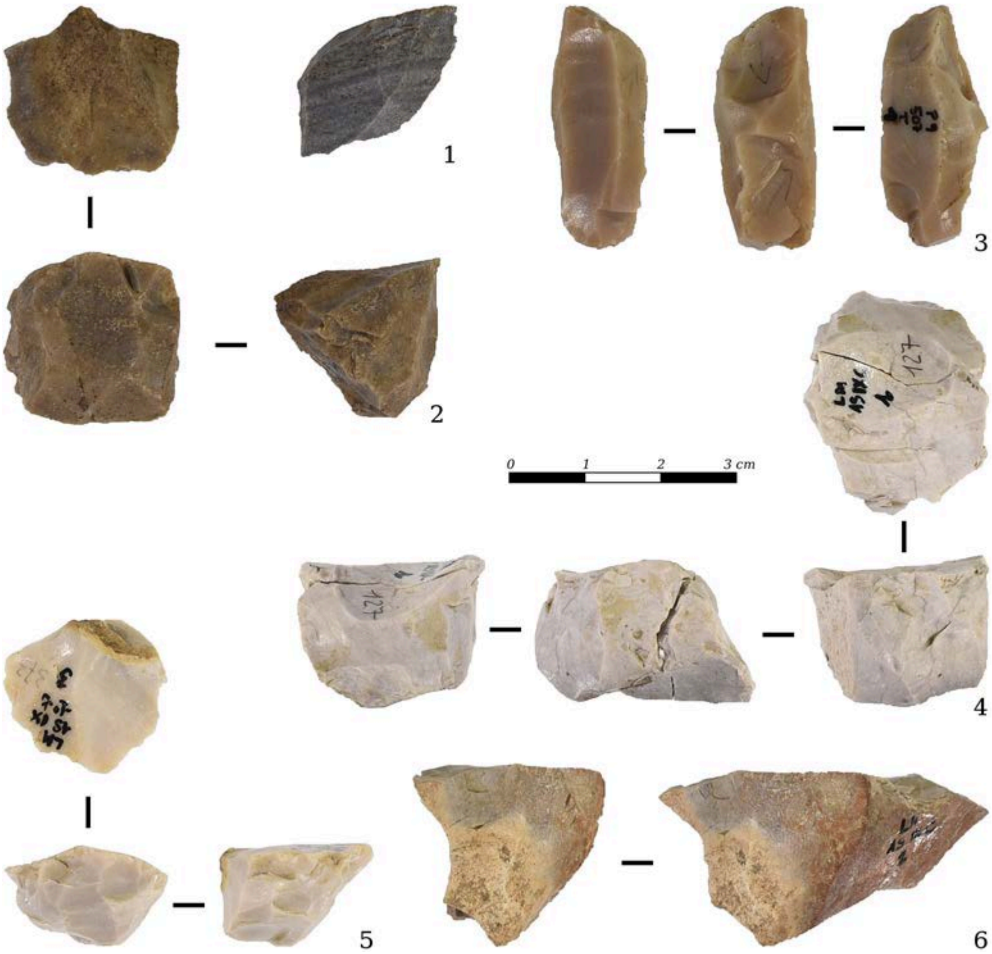

Figure 7.2: Le Mose, Plinth 9. 1-3, cores. Lithic scatter IX. 3-6, cores. 1 and 3 are flake-cores.

Table 7.11: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Objectives of the production attested by cores.

	VII		IX		XIV		Pl. 9	
Bladelets	3	37.5%	1	33.3%	5	50.0%	2	66.7%
Laminar flakes	2	25.0%			3	30.0%		
Mix	1	12.5%	2	66.7%	1	10.0%	1	33.3%
Undetermined	2	25.0%			1	10.0%		
Total	8	100%	3	100%	10	100%	3	100%

were used. When two debitage surfaces were exploited, mainly as a consequence of core reorientation, two or more striking platforms were adopted. These latter were mostly located on orthogonal faces of the cores. Cores from scatter VII present predominantly a semi-tournant exploitation modality while those from scatter XIV a frontal one, either wide or narrow. In 5 cases blanks used as cores are represented by flakes. These are generally small sized (less than 40 mm) and are consistent with some of the initialisation (or, more generally, the earliest flaked) elements of the current reduction scheme. Flake-cores were used either as burin-like cores (3) or with a frontal semi-tournant exploitation from the ventral face (2).

At a general level raw materials seem to have been intensively exploited as all the cores were abandoned at an advanced stage of debitage but for one piece belonging to scatter XIV. In some cases cores were abandoned after reaching supposed minimum dimensions while in others because of volumetric or maintenance problems (e.g. hinged removals).

Table 7.12: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Number and relative position of striking platforms (ds = debitage surface).

	VII		IX		XIV		Pl. 9	
One	3	37.5%	1	33.3%	2	20.0%		
One +1 secondary	2	25.0%			1	10.0%		
Two opposites - same ds			1	33.3%	2	20.0%	1	33.3%
Two opposites - diff. ds					1	10.0%	1	33.3%
Two orthogonal - diff. ds					2	20.0%	1	33.3%
Two orthogonal - same ds	1	12.5%						
Three					1	10.0%		
More than three			1	33.3%				
Undetermined	2	25.0%			1	10.0%		
Total	8	100%	3	100%	10	100%	3	100%

7.5 Blanks selection and transformation

7.5.1 Microlithic armatures

For the production of microlithic armatures lamellar blanks were preferentially selected at least as far as lithic scatter VII and XIV are concerned (Table 7.14). Nonetheless the

Table 7.13: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Number and relative position of debitage surfaces.

	VII		IX		XIV		Pl. 9	
One	6	75.0%	2	66.7%	5	50.0%	1	33.3%
Two consecutive			1	33.3%	3	30.0%	2	66.7%
Two opposite					1	10.0%		
Undetermined	2	25.0%			1	10.0%		
Total	8	100%	3	100%	10	100%	3	100%

Table 7.14: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Blanks selected for the production of retouched tools.

	VII		IX		XIV		Pl. 9	
Bladelet	6	42.9%			13	38.2%	1	20.0%
Bladelet/flake	6	42.9%	6	85.7%	16	47.1%	4	80.0%
Laminar flake	2	14.3%			2	5.9%		
Nat. backed bladelet					2	5.9%		
Flake			1	14.3%				
Undetermined					1	2.9%		
Total	14	100%	7	100%	34	100%	5	100%

use of flakes and lamellar by-products such as (cortical) naturally backed bladelets is also attested. This is confirmed also by the analysis of transformation wastes.

These blanks were modified with abrupt, invasive and mostly direct retouches that, at least in a few cases, were created by pressure flaking (lithic scatter XIV). Rarely inverse and bidirectional retouches are also attested. Complementary, partial, abrupt or simple, marginal retouches could be used to finalize and perfectionate the morphology of the microliths. For their production the microburin technique was often used as attested by the numerous wastes (Table 7.15) and by the some *piquant-trièdre*. In all the lithic scatters, microburins are mostly proximal and present the notch on the right side (respectively 57%, 83%, 56% and 33%). Distal microburins, on the other hand, were all realized with a notch on the left side but for 6 elements from lithic scatter XIV.

Table 7.15: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Wastes of the transformation phase.

	VII		IX		XIV		Pl. 9	
Proximal microburins	7	70.0%	6	54.5%	16	57.1%	3	60.0%
Distal microburins	1	10.0%	3	27.3%	10	35.7%	2	40.0%
Double microburins			1	9.1%				
Fractured notches	2	20.0%	1	9.1%	1	3.6%		
Krukowski microburins					1	3.6%		
Total	10	100%	11	100%	28	100%	5	100%

Table 7.16: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Microlithic armatures.

	VII		IX		XIV		Pl. 9	
Backed points	2	14.3%	1	14.3%	9	26.5%		
Sauveterre	*1*	*7.1%*			*5*	*14.7%*		
natural base	*1*	*7.1%*	*1*	*14.3%*	*4*	*11.8%*		
Crescents					3	8.8%		
Scalene triangles	2	14.3%	1	14.3%	4	11.8%	1	20.0%
Backed fragments	5	35.7%	4	57.1%	18	52.9%	1	20.0%
backed fr.	*2*	*14.3%*	*1*	*14.3%*	*13*	*38.2%*		
pointed backed fr.	*1*	*7.1%*			*4*	*11.8%*		
double backed fr.	*1*	*7.1%*	*2*	*28.6%*	*1*	*2.9%*	*1*	*20.0%*
backed-and-truncated fr.	*1*	*7.1%*	*1*	*14.3%*				
Under construction	5	35.7%	1	14.3%			3	60.0%
Total	14	100%	7	100%	34	100%	5	100%

From a typological point of view, microliths are represented by few morphotypes and numerous fragments (Table 7.16; Figure 7.3). As regards lithic scatter VII, 2 backed points and 2 triangles are attested. The former are represented by a proximal backed point with a natural base and marginal complementary retouch and by an elongated Sauveterre-like point with a retouched base. This latter was realized with an abrupt direct transversal retouch on the proximal end and a lateral bidirectional retouch opposed to a marginal and partial simple one. Their dimensions are respectively 14 x 5 x 2 mm and 14 x 3 x 1 mm. Triangles are both scalene elongated types (11 x 3 x 1 mm and 11 x 2 x 1 mm) and in both of them the main point is not completely retouched. The former presents a slightly concave small base and a backed third side, the second a partial complementary retouch and a mostly unmodified *piquant-trièdre* as small base.

Similarly lithic scatter IX yielded a proximal backed point with a natural base and a scalene triangle with a backed third side that was manufactured on an oblique/transversal portion of a flake.

A higher number of entire microliths was included in lithic scatter XIV. Among backed points are attested both elongated and totally backed Sauveterre-like types and points with natural bases. Among the former, a double backed piece is attested. Three of them are proximal points and three present a complementary retouch. All the points with a natural base were manufactured with a partial backing, in 3 of them the point is proximal and in 2 the backed side convex. Dimensions span between 11-24 mm in length, 3-6 mm in width and 1-3 mm in thickness for Sauveterre-like points and 16-23 mm, 5-9 mm and 1-2 mm for those with a natural base. Additionally 3 crescents and 4 scalene triangles are attested. Among them only one triangle presents a partial marginal retouch on the third side. Crescents are averagely shorter than triangles: 8-13 mm with respect to 12-16 in length, while width and thickness are comparable (4-3 mm and 1-2 mm). The single triangle belonging to plinth 9 is elongated and presents a complementary retouch. All of the lithic scatters but that named XIV included also unfinished microliths, presumably abandoned during construction.

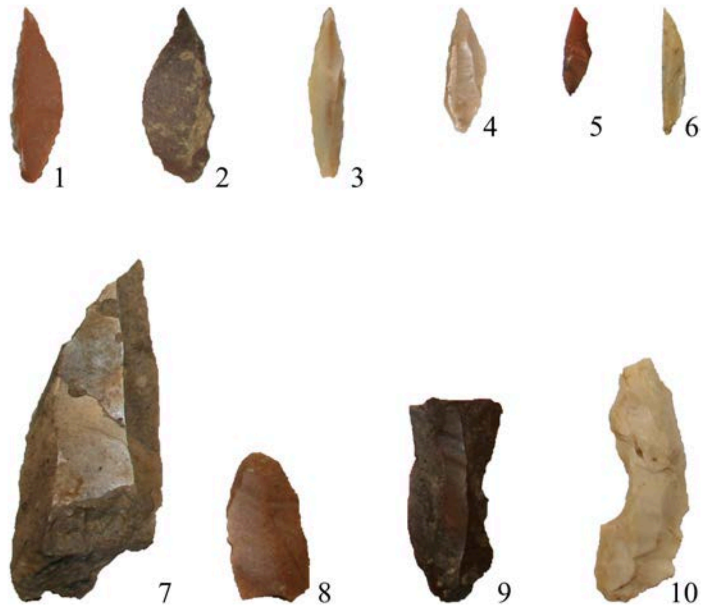

Figure 7.3: Le Mose, lithic scatter XIV. Lithic industry: 1-5, backed points; 6, crescent, 7, backed knife, 8, endscraper, 9-10, denticulated pieces (after Fontana et al., 2017)

7.5.2 Retouched tools

Blanks selected for the manufacture of retouched tools are much more varied and include both products and by-products, either laminar or flake-like, but also initialisation and maintenance elements (Table 7.17).

In all the lithic scatters, burins are the most attested type (Table 7.18), representing up to 70% of the assemblages (Plinth 9) (Figure 7.4). They were mostly realized on flakes and (semi-)cortical flakes although occasionally also thick laminar by-products such as on edge and naturally backed blades were selected. In lithic scatter VII a simple burin and a double burin on oblique truncation are attested. A simple burin and two dihedral (1 oblique and 1 right angled) are included in lithic scatter XIV. Four of the 5 burins of lithic scatter IX were manufactured on right angled truncations while the latter is a double tool opposing a burin on truncation to a right angled dihedral one. Burins on truncation are the most attested type also in the assemblage of plinth 9 (5 artefacts, among which 2 double types). The other 2 are a burin on fracture and a double one opposing a simple to a dihedral burin. To this category should be associated also the naturally backed truncated flake. Retouch, in fact, seems to rejuvenate a previous burin facet. All these tools present small dimensions included between 14 and 33 mm and thickness variable between 3 and 11 mm.

All the other tool types are attested by a limited number of pieces. The four endscrapers were all manufactured on laminar blanks such as naturally crested and semi-cortical bladelets as well as proper bladelets. Two of them are ogival types, one is a nosed endscraper and the other a frontal one.

Also the three borers, two of which are axial, were manufactured on lamellar blanks, among which a partially modified burin spall is attested. Lithic scatter XIV includes also a fragmentary backed knife manufactured on a large bladelet (at least 40 mm long, 12 mm wide and 6 mm thick) with a direct lateral backing. In the distal/transversal

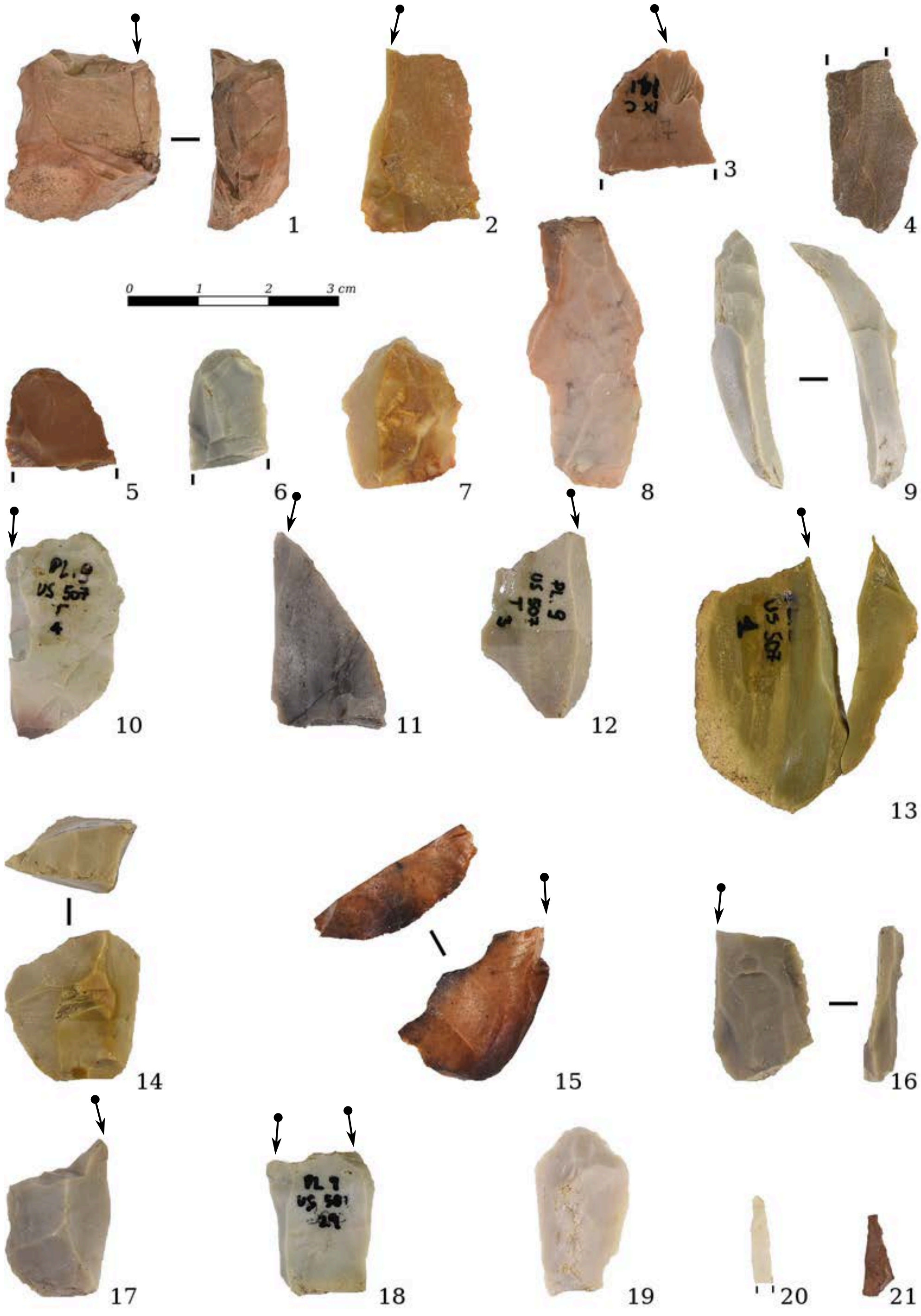

Figure 7.4: Le Mose, lithic scatter IX and Pl.9. Lithic industry (1-9 l.s. IX; 10-21 pl. 9): 1-3, burins; 4, retouched blade, 5, backed fragment, 6-7, endscrapers, 8, backed piece; 9, borer; 10-12, 15-16, 18, burins; 13, burin and buring spall; 14, truncation; 17, composite tool associating a burin and a notch; 19, endscraper; 20, backed fragment; 21, triangle.

Table 7.17: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Blanks selected for the production of retouched tools.

	VII		IX		XIV		Pl. 9	
Blades/bladelets			2	16.7%	6	42.9%		
Laminar flake	1	20.0%	2	16.7%				
Blades/flakes					1	7.1%		
Flakes			2	16.7%	2	14.3%	4	40.0%
Laminar by-products	3	60.0%	3	25.0%	2	14.3%		
Flake by-products			1	8.3%	2	14.3%	3	30.0%
Initialisation	1	20.0%			1	7.1%	1	10.0%
Maintenance flakes			1	8.3%			1	10.0%
Different			1	8.3%			1	10.0%
Total	5	100%	12	100%	14	100%	10	100%

portion the retouch presents a convex delineation and is bidirectional. Among multiple tools, pieces associating a burin to a backed or notched side are the most numerous (3). In the remaining two, a marginally backed side is associated to a retouched one and to a truncation. The other tools present partial abrupt or semi-abrupt retouches, mostly marginal and direct. In one case the retouch creates a denticulated edge and in three a notch.

Table 7.18: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Retouched tools.

	VII		IX		XIV		Pl. 9	
Burins	2	40.0%	5	41.7%	3	21.4%	7	70.0%
Endscrapers			2	16.7%	1	7.1%	1	10.0%
Truncations							1	10.0%
Borers	1	20.0%	1	8.3%	1	7.1%		
Backed knives					1	7.1%		
Backed pieces			2	16.7%	1	7.1%		
Backed fr.					1	7.1%		
Retouched pieces			1	8.3%				
Retouched fr.			1	8.3%				
Denticulates					1	7.1%		
Notches					3	21.4%		
Composite tools	2	40.0%			2	14.3%	1	10.0%
Total	5	100%	12	100%	14	100%	10	100%

7.6 Use and wear

The assemblages of lithic scatter IX and plinth 9 were analyzed in order to identify possible use-wear. All the artefacts entered into the database were considered, while smaller fragments were generally excluded. Totally 137 artefacts belonging to lithic scatter IX and 54 belonging to Plinth 9 were observed.

At a general level preservation state is good, with the exception of a high number of thermally altered artefacts. Surface alterations are limited to the presence of few abraded areas. Mechanical damages and taphonomic scarring, on the other hand, are more developed although their presence and distribution is highly variable as some pieces are heavily damaged while others appear almost intact.

Microliths are not numerous in the two assemblages (respectively 7 and 5) and none of them yielded use-wear traces. Only one backed-and-truncated fragment features a bending fracture possibly attesting the use as projectile implement. Considering the type of fracture and the presence of armatures under construction in the assemblage it cannot be excluded that such a fracture is actually technological.

Table 7.19: Le Mose, Lithic scatter VII, IX, XIV and Pl. 9. Number of artefacts that yielded use-wear traces. Between brackets the number of possible traces is indicated.

	IX	Pl. 9
Burins		4(2)
Endscrapers		1(1)
Truncations		1
Borers	1(1)	
Retouched pieces	1(1)	
Composite tools		1
Blades/bladelets	1	
Laminar flakes	1(1)	
Cortical nat. backed blades	1	
Burin spalls	2	
Total	7	7

The artefacts belonging to lithic scatter IX that yielded use-wear traces are mostly represented by unmodified blanks (Table 7.19; Figure 7.5). One naturally backed bladelet and one laminar flake attest to a longitudinal motion. The former one presents a good edge rounding associated to a light degressive polish and small bifacial bending removals suggesting its use on soft materials, possibly during butchery activity. In the other one, worked material could not be determined. Some direct semicircular feather- or slightly step-terminating bending fractures, attested on the proximal portion of a bladelet fragment suggest the presence of an active zone. Edge scarring is associated to a marginal polish located on the ventral aspect and, partially, on the dorsal one (less developed). These traces are consistent with the scraping of a mid-hard material. A similar pattern is attested also on two burin spalls. In one of them the zone of use is clearly cut both by a smaller burin facet and by the burin spall itself indicating that it was the former blank (prior to the detachment of the burin spall) that had been used and not the burin spall. This latter presents a well developed and slightly domed polish that could indicate wood-working, although the presence of some alterations and of an abrasion zone along the edge do not allow its confirmation. Among retouched tools, a burin spall roughly modified into a borer exploiting the natural pointed end of the blank, presents a well developed rounding that indicates a possible use on soft/resistant materials. A cortical naturally backed bladelet featuring a partial, marginal, semi-abrupt retouch yielded 2 confirmed active zones and 2 possible ones. The two main ones correspond to the proximal and distal portion of the unmodified edge. In both of them large and regular, unidirectional or alternating removals are attested. A micro-polish is attested only on a small portion of the ventral face, not interested by edge scarring. The distribution of use-wear suggests a transversal motion with a high working angle on mid hardness materials. The two possible active zones present similar features but less developed and affected by a higher degree of post-depositional alterations. One of them corresponds to the retouched edge.

All the artefacts with use-wear traces belonging to plinth 9 are retouched ones (Table 7.19; Figure 7.6). Furthermore 6 of them are burins or present, at least, 1 burin facet. Along with three burins on truncation and one on fracture a mixed tool with a retouched notched edge opposed to a burin facet and a sort of truncation in which the retouch seems to rejuvenate a previous burin facet are attested. All the burins yielded use-wear traces in correspondence of the dihedral formed by the burin facet and either the dorsal or ventral face of the blank. In three of them use-wear is represented by the presence of overlapping, perpendicular, step- or hinge-terminating, bending removals, mostly of trapezoidal or quadrangular morphology. In two others a marginal flat polish, parallel to the edge and localised is attested along with a partially preserved polish-bevel. In general these traces are consistent with the transversal working of hard materials, in a few case possibly interpretable as bone. On the multiple tool a second possible zone of use is located in correspondence of the notched edge, where a well developed edge rounding was identified. Three different edges of the truncated flake were used to carry out the same activity, the retouched and the two lateral, unmodified ones. With respect to the other tools, these scares are rather large and invasive, at least as far as the two lateral zones of use are concerned. Finally a nosed endscraper presents a marginal, indeterminate polish associated to the edge rounding of the endscraper front. This suggests the possible scraping of an undetermined material.

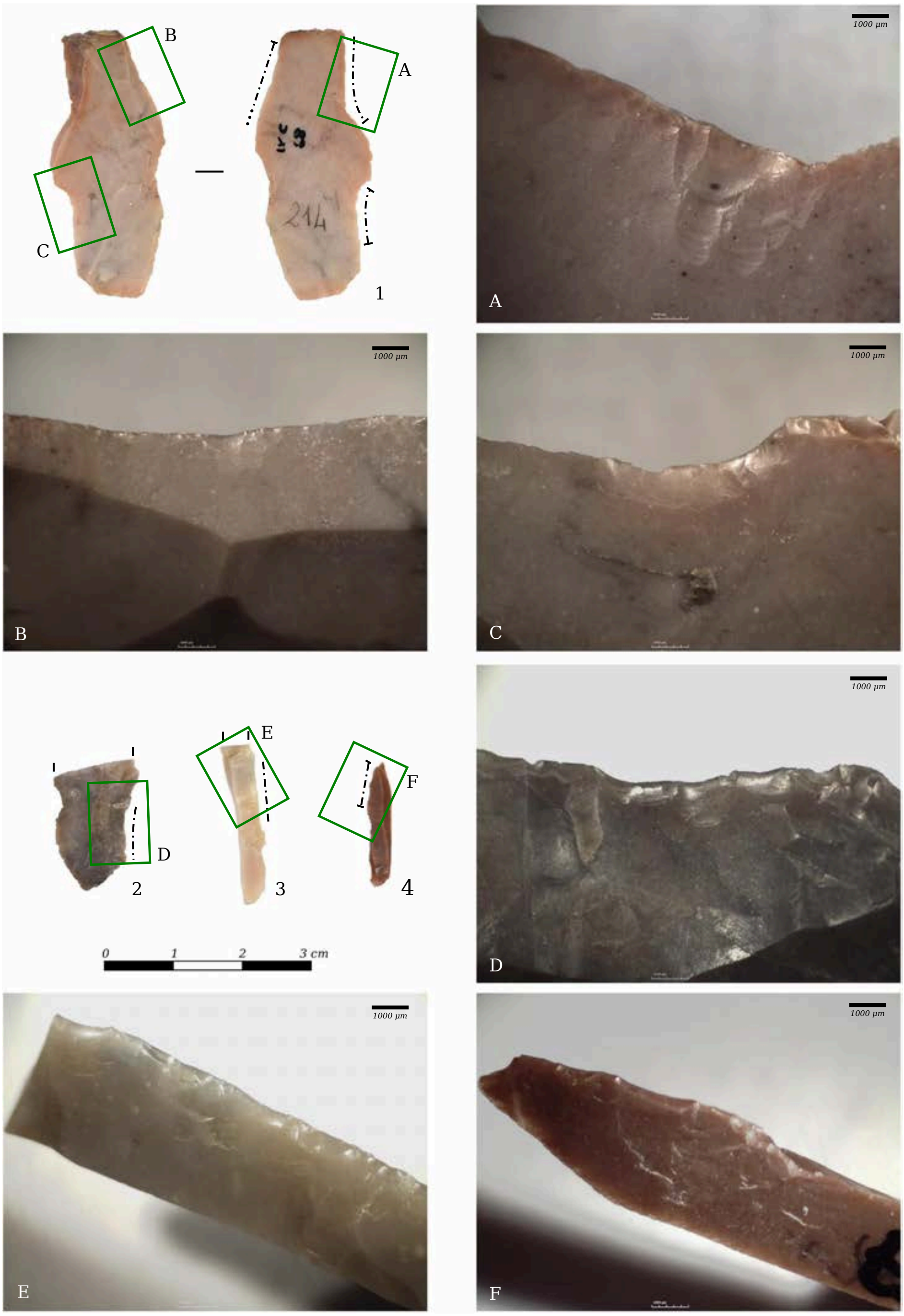

Figure 7.5: Le Mose, lithic scatter IX. Large and regular, semicircular/quadrangolar, slightly hinged or step terminating removals consistent with the scraping of a mid hardness material (possibly wood). Use-wear was indentified both on lamellar blanks and burin spalls. Figure E attests that use-wear precedes the detachment of the burin spall as edge scarring is cut by a previous burinant removal.

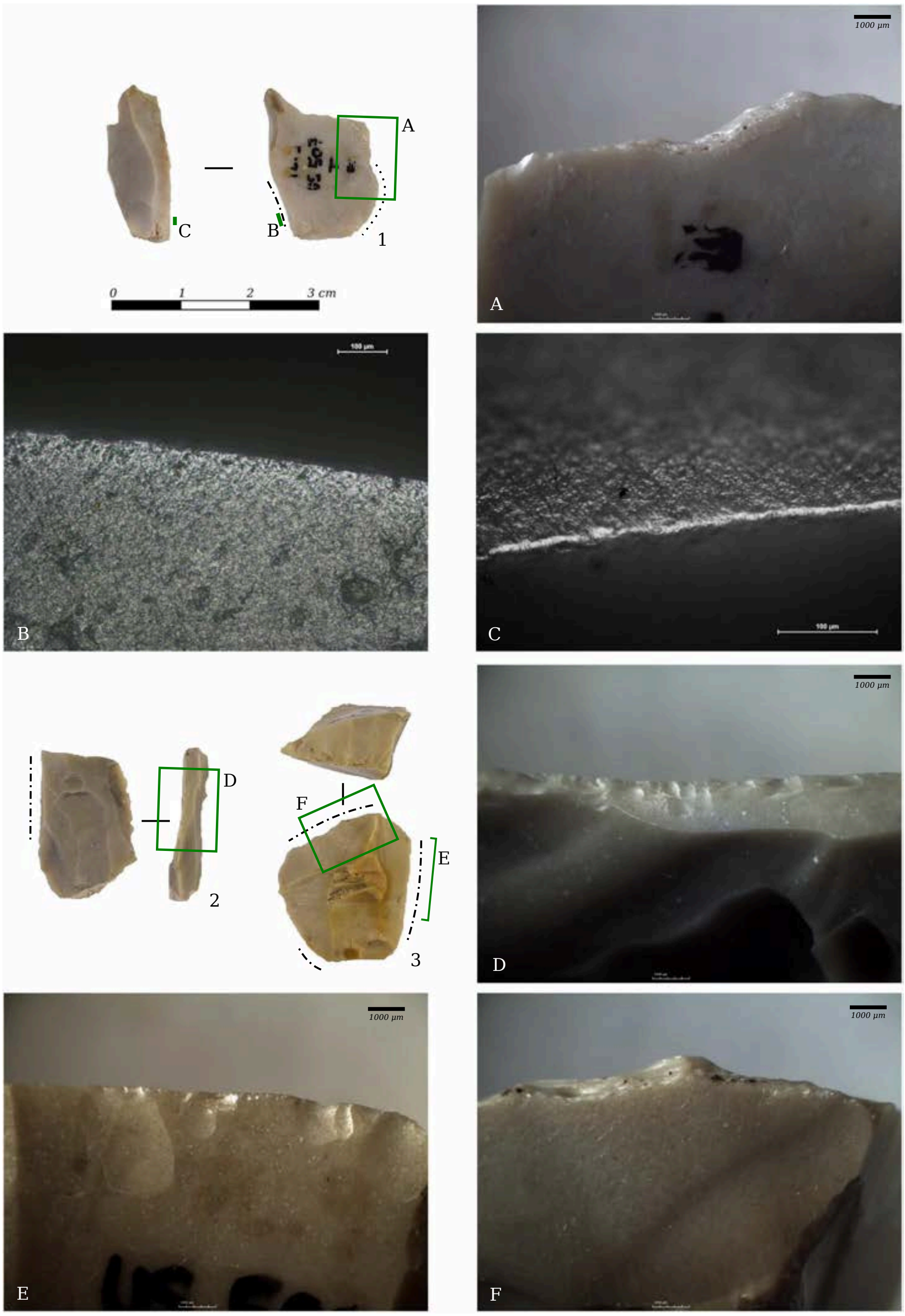

Figure 7.6: Le Mose, Plinth 9. Burin 1 was used for scraping bone as attested by the flattish bevelled polish on the lateral dihedral (C) with the burin facet as leading surface (B). On the opposite retouched edge a marked rounding is attested (A); D-E, edge scarring consistent with the scraping of a hard material; F, marked rounding on the truncated edge, consistent with that of figure A.

Chapter 8

Collecchio

Contents

8.1 Site introduction

The site of Collecchio (Parma, Emilia Romagna) is located at the far edge of the alluvial fan of the river Taro, a right tributary of the river Po, at the southern margin of the Po plain. In 1992 during some roadworks a Middle Neolithic settlement was brought to light. The Early Mesolithic layer (S.U. 77) was identified two years later (December 1994) in the lower part of a thick buried vertisol developed on the top of a coarse alluvial deposit (Visentin et al., 2016a) (Figure 8.1). The Mesolithic occupation probably took place at the very beginning of the stable phase that later brought to the formation of the buried vertisol (during the Boreal). The excavation, encompassing an area of around 70 square metres, was based on a 33 cm grid and all sediments were water-screened and sorted. This allowed the collection of more than seven thousand lithic artefacts along with burnt bone fragments, seeds, charcoal, shells and burnt clay lumps.

Two radiocarbon datings (AMS) place the Mesolithic occupation of the site in the mid part of the Preboreal (Table 8.1). Currently Collecchio represents the first undeniable evidence of reoccupation of the southern Po Plain after the Last Glacial Maximum (Visentin et al., 2016a).

Several snail shells recovered during the excavation were analyzed and determined (Visentin et al., 2016a). They are referred to three species of terrestrial pulmonate gastropods: *Chondrula tridens* (O.F. Müller, 1774), *Cernuella* cf. *cisalpina* (Rossmassler,

Figure 8.1: Collecchio, the reference grid indicates the excavated area of the site (after Visentin, 2011).

Table 8.1: Collecchio. Available radiocarbon datings.

Layer	Lab. ID	Material	Radiocarbon age	Calib. age BP (2σ)
SU 77	LTL6147A	Hazelnut	9643±70	11,178-11068 (31.5%) 10,957-10,864 (25.5%) 10,850-10,799 (11.2%)
SU 77	LTL12390A	Charcoal	9442±60	11,068-10,955 (10.1%) 10,865-10,849 (0.9%) 10,806-10,513 (84.4%)

1837) and *Cepaea* cf. *nemoralis* (Linnaeus, 1758). Both *Cepaea* cf. *nemoralis* and *Cernuella* cf. *cisalpina* are edible gastropods but available data do not allow to advance any hypothesis on their possible role in the diet of the Mesolithic groups of Collecchio as their intentional collection cannot be demonstrated.

Anthracological and carpological findings suggest that the surroundings of the site were dominated by deciduous broadleaves and especially by chestnut, poplar-willow—a species typical of hygrophilous woods—and other *taxa* which are characteristic of the mixed oakwood (*Quercetum)*, such as oak, hornbeam, ash, maple and thorn tree (Visentin et al., 2016a). Moreover 33 fragments of nuts of *Corylus avellana* that can be referred to a total of 9-10 specimens were identified.

Faunal remains are scarce and mostly represented by burnt fragments. The identified specimens consist of wild boar, hare, fox and wild cat. 27 elements were anatomically identified. These refer to the distal part of limbs (phalanges, carpal and tarsal bones). Only three of them belong to different parts of the skeleton: a molar of *Vulpes vulpes*, one of *Sus scrofa* and a coxal bone of *Lepus europaeus*.

A spatial analysis that encompassed all the organic and lithic remains allowed reconstructing the organisation of the site (Visentin and Fontana, 2016). The identification of specialized areas dedicated to the processing of different materials and to the preparation/repairing of arrowheads is consistent with a complex mid-term occupation, possibly part of a wider settlement.

8.2 Lithic assemblages

The entire lithic assemblage consisting of 7697 artefacts was analysed. 2785 artefacts were considered to be diagnostic and entered into the database (Table 8.2). Blanks with a length smaller than 1 cm have been counted (n. 825) and sorted by lithology. The lithological determination of raw materials was performed by S. Bertola while use-wear analysis was carried out by G.F. Berruti and S. Ziggiotti (Berruti, 2008; Visentin et al., 2016a).

Table 8.2: Collecchio. Composition of the lithic assemblage.

Cortical and semi-cortical blanks	553	7.2%
Laminar blanks	464	6.0%
Flake blanks	814	10.6%
Maintenance blanks	218	2.8%
Burin spalls	92	1.2%
Undetermined fr.	4346	56.5%
Flakes < 1 cm	859	11.2%
Retouched blanks	224	2.9%
Transformation wastes	27	0.4%
Cores	100	1.3%
Total	7697	100%

By a general viewpoint the lithic assemblage presents a good preservation state: only about 26% of the pieces are thermally altered (Table 8.3) and around 50% of them are entire or incomplete (Table 8.4). The percentage of items attesting edge damage, presence of patina and/or other mechanical/chemical post-depositional alterations is rather low (15%). Patinas, in particular, seem to be selectively attested on the less silicified lithologies. In accordance with the characteristics of the sedimentological context and the results of spatial analysis this data confirm the rapid burial of the archaeological deposit after abandonment of the site by the Mesolithic groups.

Table 8.3: Collecchio. Thermal alteration of the artefacts.

Unaltered	5701	74.1%
Altered	1996	25.9%
Total	7697	100%

During a previous study (Visentin, 2011; Visentin et al., 2014) numerous refittings were carried out. Totally 329 pieces, composing 122 complexes, were involved. The maximum number of artefacts per refitting complex is 12. These attest to all the stages of the reduction sequence, from the initializing phase to the abandonment of cores, thus confirming that all these operations took place on site. Also a few retouched pieces were refitted and positioned in the reduction sequence.

Table 8.4: Collecchio. Integrity of the artefacts entered into the database.

Entire	847	31.5%
Incomplete	508	18.9%
Fragments	1330	49.5%
Total	2685	100%

8.3 Raw material provisioning

A large spectrum of lithologies, all belonging to the Northern Apennine stratigraphic sequences, was flaked at Collecchio. On the basis of their lithology, age and texture, raw materials groups were attributed to specific formations belonging to different paleogeographic domains. In particular the following resources were exploited:

- Ligurid ophiolitic units (Radiolarites, cherts of the Calpionella Limestones, cherts and limestones of the Palombini Shales); Jurassic-Cretaceous age.
- Ligurid Flysch units (Monte Sporno Flysch); Paleocene-Eocene age.
- Epiligurid units (silicified marls and siltstones from the Antognola and Contignaco formations); Oligocene-Miocene age.
- Umbro-Tuscan units (Calcari Selciferi, Scisti Diasprigni and Maiolica); Triassic–Cretaceous age.

Raw materials were generally collected in secondary deposits not far from the outcrops as testified by the subangular to subrounded edges (Table 8.5). Only marginally cobbles from alluvial deposits and soils were collected.

The reconstruction of provisioning territories suggested that groups' mobility was included within an area spanning from the foothill to the mid Apennines, following the main drainage systems and spacing between the Trebbia, to the west, and the Baganza valley, to the east, on the Emilian side of the Apennines (Visentin et al., 2016a).

In light of the result of technological analysis, the above mentioned lithologies were regrouped into three main classes reflecting their technical properties and knapping suitability (Table 8.6). The best quality class (named "A") is represented by the finest cherts and radiolarites while the second one (B) includes low silicified limestones, spiculitic cherts and radiolarites. The third class (C) is composed only by low silicified coarse marly siltstones available in the surroundings of the site as large flattish slabs.

Table 8.5: Collecchio. Collection context of raw material groups.

	Class A		Class B		Class C	
Slope deposit	223	47.1%	161	78.2%	194	99.5%
Alluvial cobble	5	1.1%				
Soil	24	5.1%				
Undetermined	221	46.7%	45	21.8%	1	0.5%
Total	473	100%	206	100%	195	100%

Table 8.6: Collecchio. Exploited lithologies subdivided according to raw material classes.

	Class A		Class B		Class C	
Tr. di Contignaco			5	0.5%		
Antognola Fm.			172	16.0%	307	100.0%
Monte Sporno Flysh	423	21.8%				
Palombini Shales	208	10.7%	166	15.5%		
Calpionella Lm./Maiolica Fm.	775	40.0%				
Monte Alpe Cherts Fm.			689	64.2%		
Scisti Diasprigni Fm.	152	7.8%				
Cherty Limestone Fm.	379	19.6%	42	3.9%		
Total	1937	100%	1074	100%	307	100%

8.4 Reduction schemes

The finest cherts and the mid-quality raw materials such as radiolarites and limestones (Classes A and B) were exploited according to two interrelated reduction schemes, while the coarser siltstone (Class C) was flaked following a completely independent and autonomous scheme.

The first reduction scheme (Classes A and B) was aimed at the exploitation of large cobbles and slabs (most likely larger than 10 cm). During the first stage, a few laminar blanks and numerous large flakes were produced. At least for some raw materials, such phase is supposed to have taken place elsewhere being attested on-site only by flaked blanks. Later the massive production of bladelets, small lamellar flakes and flakes started, whose length values range from 10 to 40 mm (Table 8.7).

The second reduction scheme (Classes A and B) was aimed at the on-site exploitation of small cobbles and of the large flakes issued from the first scheme. The sets of products feature the same characteristic of the former ones.

The third reduction scheme (Classes C) was dedicated to the flaking of cortical, flattish, siltstone slabs. Products of this reduction scheme are represented by thick semi-cortical and naturally backed flakes, 25 to 75 mm long.

8.4.1 Initialization

As regards the first reduction scheme, it is quite difficult to identify the modalities in which debitage was initialized. As anticipated in the previous paragraph, this phase took mostly, if not entirely, place elsewhere. As demonstrated by the refitting programme some of the raw material units were brought to the site as large flakes, while the elements connectable to their production are completely missing. Such a phase could have taken place directly either on the collection spots (e.g. it is easy to remove large flakes from the big limestone blocks lying on the stream beds) or in an un-investigated part of the settlement. In other cases, such as for Tertiary Flysch cherts and radiolarites, it is possible that the entire exploitation took place on-site, although this is difficult to prove, being all of the products of this phase exploited either as cores or retouched tools.

In any case it can be surmised that the initialisation modalities of the first and second reduction schemes were similar. Raw blocks are represented by nodules

Table 8.7: Collecchio. Products and by-products.

	Class A+B		Class C	
Main products	**1004**	**66.3%**	**105**	**47.7%**
Blades	335	33.4%	7	6.7%
Laminar flakes	35	3.5%		
Flakes	634	63.1%	98	93.3%
Laminar by-products	**171**	**11.3%**	**11**	**5.0%**
Semi-cortical blades	44	25.7%	7	63.6%
On the edge blades	12	7.0%		
Semi-cortical on the edge blades	6	3.5%		
Naturally backed blades	73	42.7%	2	18.2%
Cortical naturally backed blades	36	21.1%	2	18.2%
Flake by-products	**340**	**22.4%**	**104**	**47.3%**
Semi-cortical flake	216	63.5%	72	69.2%
Naturally backed flakes	71	20.9%	12	11.5%
Cortical naturally backed flakes	53	15.6%	20	19.2%
Total	1515	100%	220	100%

and nodule fragments, mostly featuring morphologies fitted to be directly exploited. In particular natural fractures characterized by thick patinas were frequently used as striking platforms. Debitage was, generally, directly started by exploiting the natural convexities and ridges of the selected cobbles. The most frequent initialisation elements, in fact, are represented by opening blades/flakes and naturally crested blades (Table 8.8). More complex modalities are attested by a crested blade and a partially crested one. The low frequency of these types of blanks, anyways, suggest that this was only an occasional procedure.

A direct initialisation of the debitage can be proposed also for the third reduction scheme (raw material class C). In this case large flattish blocks featuring natural rounded to sub-rounded edges were collected in the proximity of the settlement. Their dimensions are supposed to be 10-12 cm wide and 5-6 cm thick. Length is more difficult to estimate but it is thought to be at least 20 cm long. Cortex is formed by the alteration of the external surface.

Table 8.8: Collecchio. Initialization blanks.

	Class A+B		Class C	
Crested blades	1	1.1%		
Partially crested blades	1	1.1%		
Opening blades	10	11.2%	1	10.0%
Naturally crested blades	12	13.5%		
Opening flakes	19	21.3%	4	40.0%
Generic cortical flakes	46	51.7%	5	50.0%
Total	89	100%	10	100%

8.4.2 Production

The production of the first stage of the first reduction sequence is ephemeral and, probably not standardized. Very few laminar products and by-products with length spanning between 45-50 and 89 mm are attested in the recovered assemblage. Mostly large cortical or semi-cortical flakes destined to be used as core-blanks were produced.

Following this phase, reduced cores were exploited for the production of a wide set of smaller products. From this stage onwards the productive process is identical to that of the second reduction scheme that, on the other hand, started with smaller cobbles. They will, thus, be described conjointly. The set of products includes both bladelets, laminar flakes and flakes (Table 8.9; Figure 8.2). Length values are smaller that 35-40 mm for all of the categories. Half of the bladelets, in particular, are clustered between 14 and 24 mm in length. Flakes mean value is smaller than that of laminar blanks.

Table 8.9: Collecchio. Summary of the metric values of debitage products and by-products (A = blades, B = laminar by-products, C = flakes, D = flake by-products).

		Class A+B				Class C	
		A	B	C	D	A	B
Length	Min.	7	8	10	6	9	8
	1st Qu.	14	16	12	14	20	27.25
	Median	18	21	13.5	18	29	38
	Mean	20.45	23.09	15.16	20.01	28.4	39.55
	3rd Qu.	24.25	27.5	16	23.5	35	51.75
	Max.	89	71	65	68	66	75
	SD	10.14	9.77	6.07	9.26	11.82	14.97
	Count	148	91	287	255	72	82
Width	Min.	2	3	5	4	6	13
	1st Qu.	5	6	9	12	15.25	25
	Median	8	8.5	12	15	22	35.5
	Mean	8.62	9.46	12.58	16.82	25.94	38.71
	3rd Qu.	11	11	15	20	33	49.5
	Max.	27	30	37	57	90	90
	SD	4.08	4.95	4.91	7.85	14.63	17.78
	Count	286	168	255	263	70	82
Thickness	Min.	1	1	1	1	2	2
	1st Qu.	2	2	2	3	4	7
	Median	2	4	3	4	6	11
	Mean	2.47	4.33	3.02	5.48	6.95	11.8
	3rd Qu.	3	5	4	6.25	9	14.25
	Max.	10	18	12	77	19	41
	SD	1.32	2.82	1.78	5.11	3.97	6.71
	Count	287	171	287	287	98	104

Debitage preferentially consisted of unidirectional sequences of removals and, in some cases, a single striking platform was exploited until the abandonment of the core (Figure 8.3 n.3). Otherwise cores were reoriented through orthogonal laminar or flake removals (Table 8.10; Figures 8.3; 8.4). The orthogonal reorientation of cores

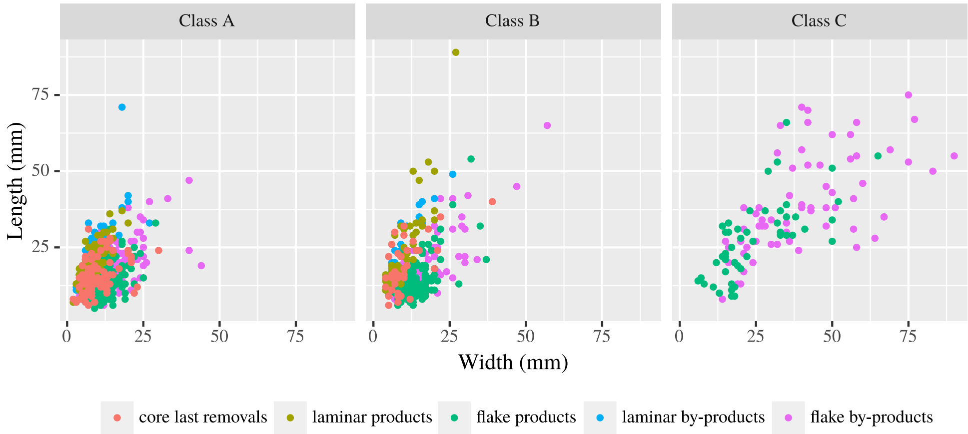

Figure 8.2: Collecchio. Scatterplot of length and width values of products, by-products and core last removals.

was more frequent during flake production. The number of laminar blanks attesting orthogonal scars is much lower. Surface maintenance blanks were mostly detached from the same striking platform. Flakes removed from an opposite platform are rarer. The maintenance of the longitudinal and transversal convexities was achieved also through orthogonal removals creating neo-crests and partial neo-crests. The overhang of the striking platforms was generally well trimmed only during bladelet production (attested on more than half of the blanks). In all of the other categories this value drops significantly. The maintenance of striking platform is attested by a few *tablettes* and a good number of flakes. These are generally connected to the shaping-out and maintenance of cores realized on large flakes.

As far as knapping techniques are concerned the lithic industry appears quite homogeneous. The only technique that seems to have been adopted is direct percussion with a soft stone hammer. In relation to the size and type of seeked removals this could be applied with a tangential (thinner and more regular blanks) or perpendicular motion (larger and thicker flakes). The main characteristics supporting this hypothesis are the widespread presence of the lip, the butt morphology, which is usually small and plain but also linear and point-shaped, sometimes showing a marked percussion point, and the abrasion of the overhang, that is not systematic. *Esquillement du bulbe* is also present but scarcely represented. This hypothesis is supported by the recovery of an elongated sandstone pebble with impact traces along the narrower convex edges.

The production of the large semi-cortical and cortical backed flakes that characterizes the third reduction scheme is achieved by facially exploiting a single debitage surface from two orthogonal striking platforms (Figure 8.5). Short sequences of removals from the larger platform (corresponding to the flat side of the slabs) were alternated to a few removals from a narrower lateral platform. The striking platforms were cortical. Flakes obtained with this method were, usually, characterized by a plunged termination and by cortex both on the butt, on one of the two edges and on the distal end. The butts of these flakes, furthermore, attest a very peculiar procedure to trim the overhang. This, in fact, was not abraded as with the other raw materials but was reinforced by removing a few large and short flakes on the striking platform.

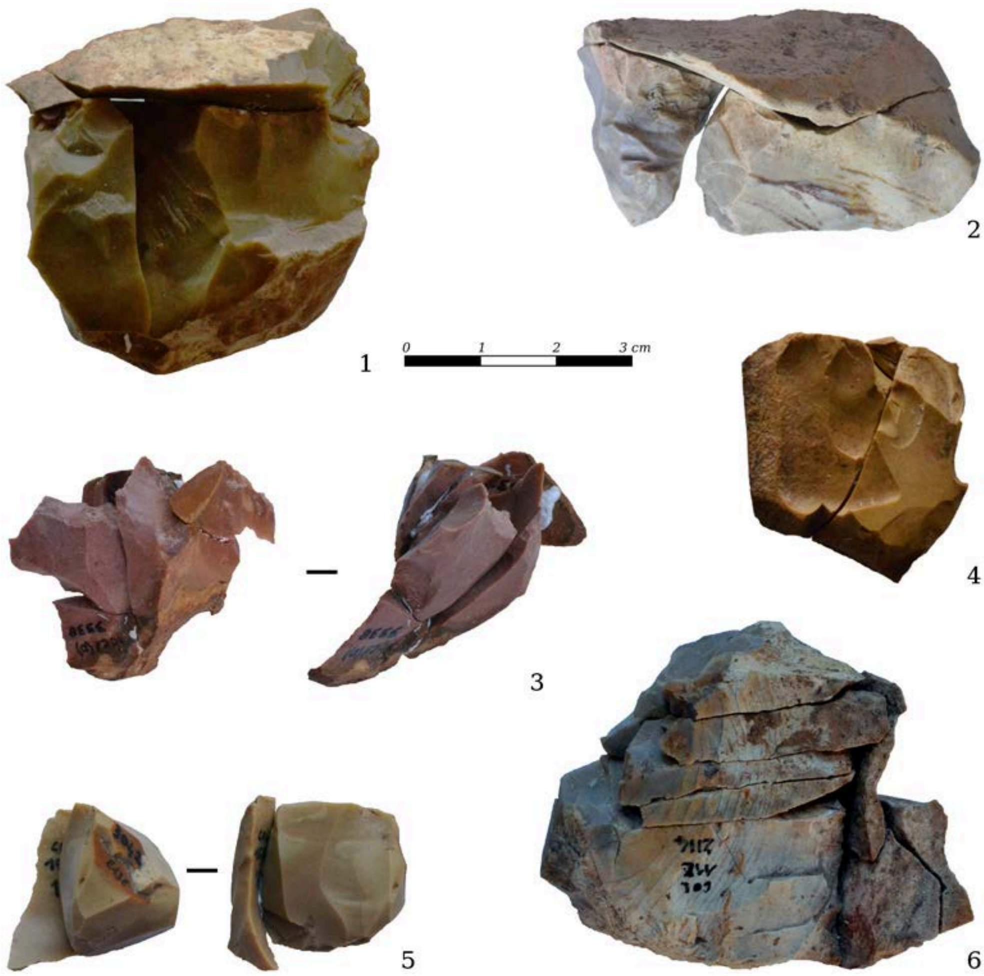

Figure 8.3: Collecchio. Refitting assemblages highlighting the variability of reduction methods of chert materials (Class A).

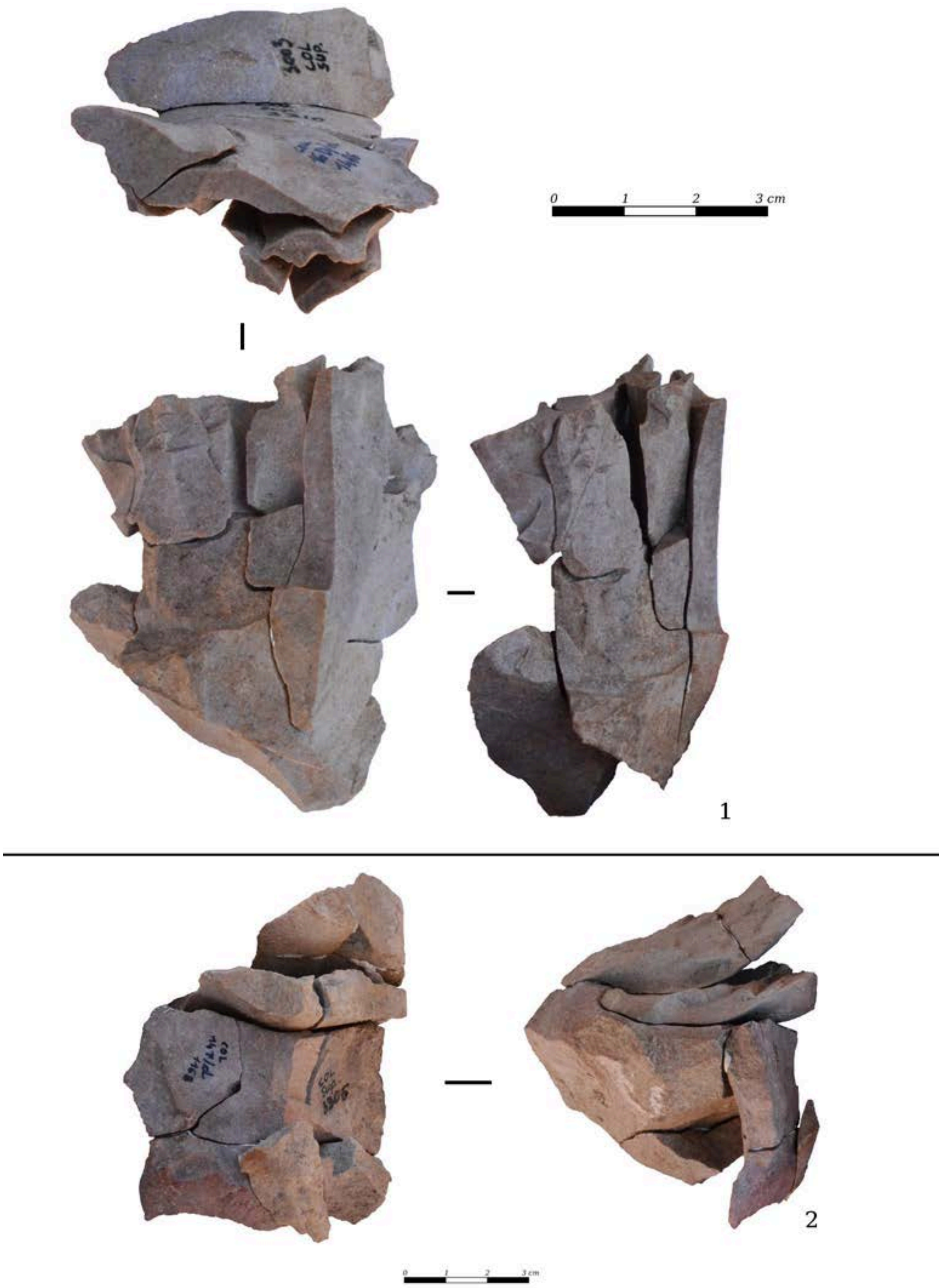

Figure 8.4: Collecchio. Refitting assemblages showing two reduction sequences of mid quality raw materials (spiculitic chert, class B).

Table 8.10: Collecchio. Maintenance blanks.

	Class A+B		Class C	
Neo-crested blades	12	5.7%		
Partially neo-crested blades	12	5.7%		
Proximal reorientation blades	5	2.4%		
Distal reorientation blades	3	1.4%	1	14.3%
Reorientation flakes	9	4.3%	4	57.1%
Surface maintenance blades	9	4.3%		
Naturally backed surface maintenance blades	4	1.9%		
Surface maintenance flakes	58	27.5%		
Naturally backed surface maintenance flakes				
Maintenance flakes from opposite st. platform	10	4.7%		
Tablettes	4			
Striking platform maintenance flakes	28	13.3%	1	14.3%
Generic maintenance flakes	57	27.0%	1	14.3%
Total	211	100%	7	100%

Unlike the technical procedure commonly applied to pressure flaking, in this case removals never reach the striking point, that was always located slightly inner on the platform.

8.4.3 Cores

Totally 100 cores were identified in the lithic assemblage. These belong exclusively to the first two classes of raw material (A and B). Among them the number of cores realized on large semi-cortical flakes is high (42%) and considering the number of undetermined cores (22%) could be even higher (Figure 8.6). No real cores were identified as far as class C is concerned. A slab that was imported on-site and not exploited belongs to this raw material group (not included in the core count).

Cores attest two main exploitation modalities, the first one is based on the frontal flaking of wide surfaces while the second one focuses on narrow edges. The frontal method usually consists of a direct flaking from a single striking platform. In other cases it implies a series of orthogonal re-orientations of the core (e.g. Figure 8.3, n. 6). The products of this method are represented by flakes and partially cortical flakes, lamellar flakes and large bladelets (Table 8.11). The second method leads to the production of more elongated elements and, most frequently, is based on the exploitation of flake-blanks as burin-like cores. These cores, often present striking platforms shaped out with orthogonal/oblique removals detached from the ventral face, similar to opening flakes. In some cases debitage can evolve into a *semi-tournant* method especially on chert cores which appear more intensively exploited. The two methods described are not to be considered as strictly independent but numerous shifting from one to the other are attested.

Half cores attest a single striking platform and a single debitage surface throughout the entire flaking process (Tables 8.12 and 8.13). Frequently 2 striking platforms were adopted but their disposition is variable and could be either opposite or orthogonal on the same surface. Cores with more debitage surfaces and/or striking platforms are also well attested and mostly connected to the raw material B class.

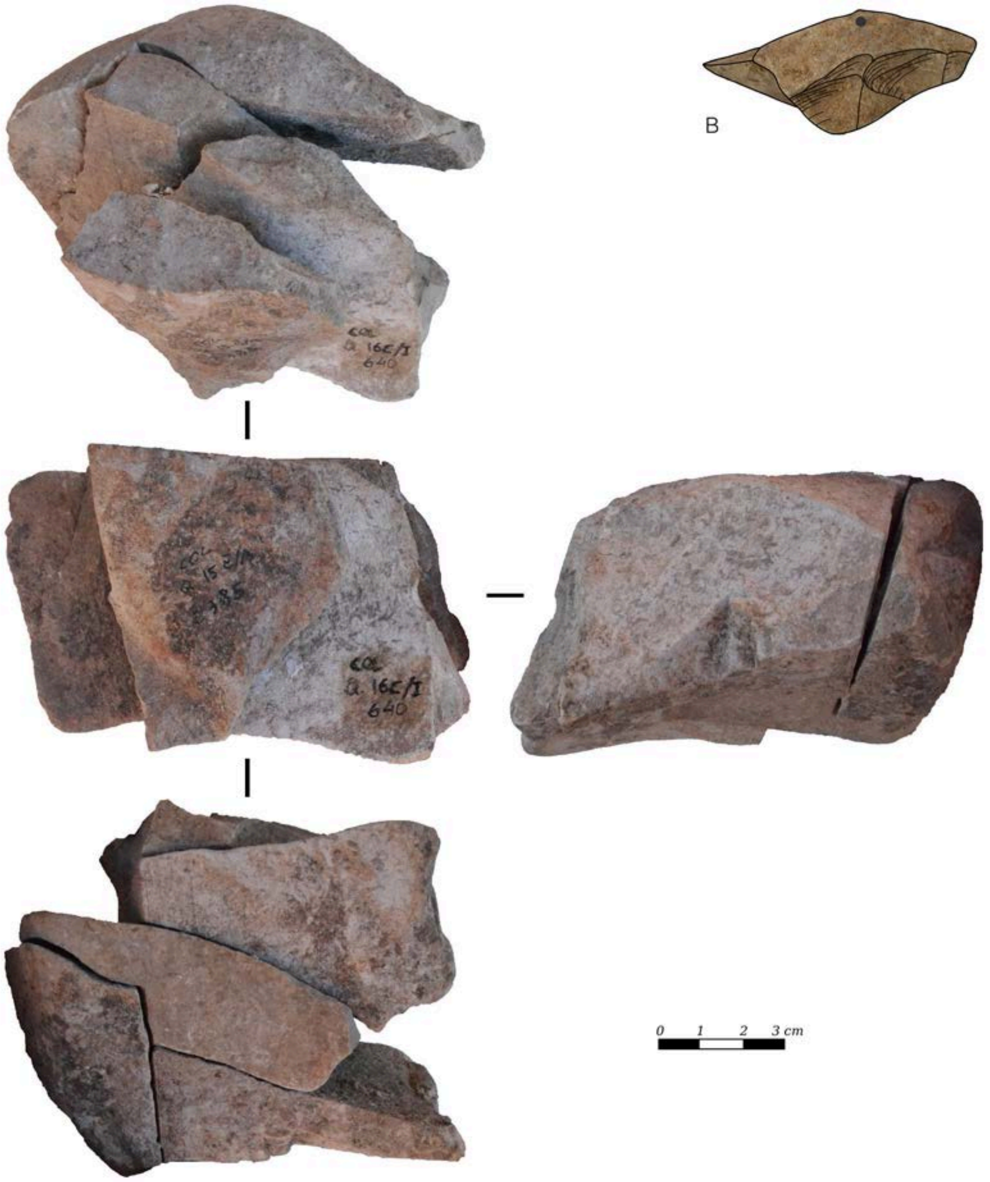

Figure 8.5: Collecchio. Refitting assemblage testifiyng the reduction sequence of a silicified siltstone slab (class C). Image B, detail of the preparation of the butt.

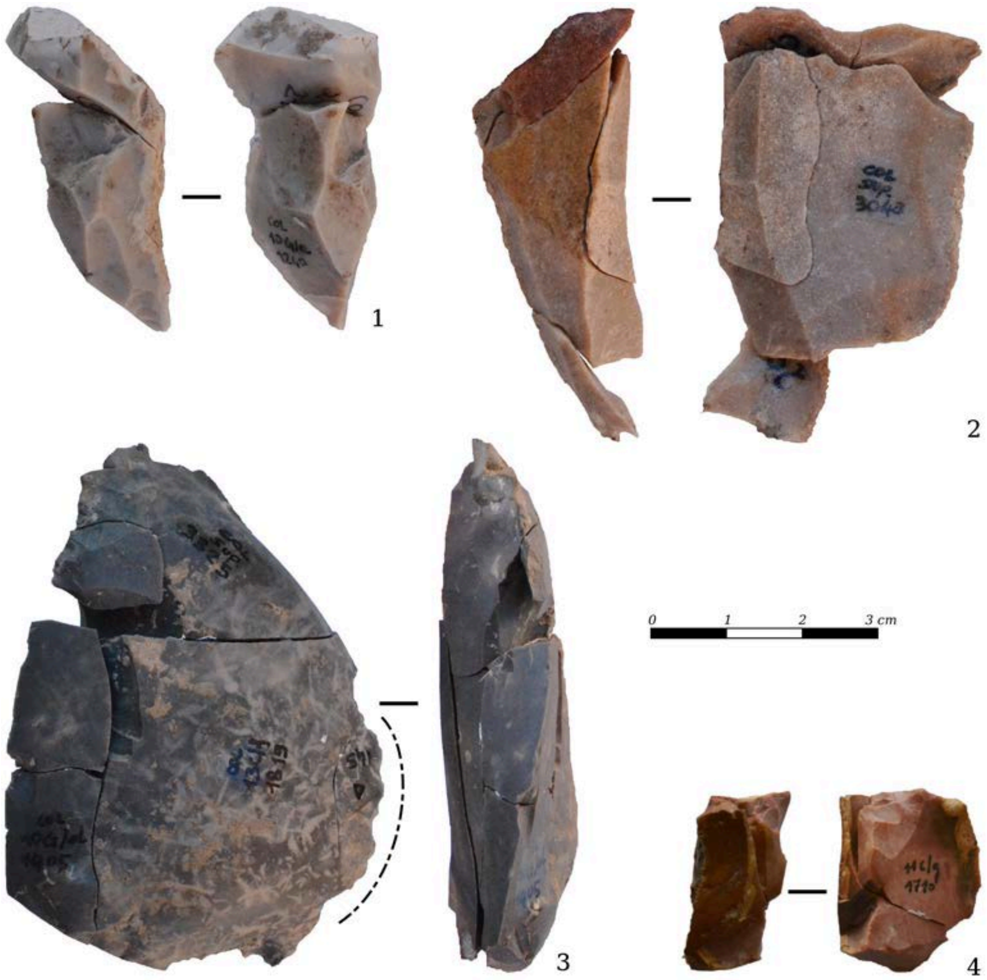

Figure 8.6: Collecchio. Different modalities of exploiting large flakes as cores: 1-2, with a striking platform created by detaching an opening flake; 3, exploiting a fracture; 4, exploiting a natural surface.

The intense exploitation of cores occurred only with the better quality raw materials (fine cherts, around 20%), while most others were abandoned either in the initial flaking stage (35%) or during the main one (38%). The occurrence of knapping errors and volumetric problems are, along with raw material quality, the main reason for the discard of the cores. It should, also be noted that 28% of them did not present any of these features and were abandoned in absence of any compelling technical causes.

The high presence of both burins and burin-like cores brought about the problem of their respective identification. These two groups have been initially sorted from a techno-typological viewpoint on the basis of the following criteria: a) dimensions, namely thickness; b) number of removals; c) location of removals on the blanks; d) preparation of the striking platform. The rationale was that cores are usually thicker than burins and that removals are generally more numerous on cores and more frequently located on the blanks ventral faces than in burins. Platforms are either plain or retouched as to create a truncation in the case of burins, plain or lightly retouched with a lower angle on burin-like cores. Use-wear analysis which was then carried out on both categories of items confirmed the validity of adopted criteria (cf. *infra*). Although this allowed to distinguish two main groups of artefacts, a morphologically intermediate group was still present. The complete pertinence of such classification, in fact, is not yet assessed. It is highly possible that blanks that were initially selected for the production of elongated bladelets were then used as tools and the other way around. At the same time a burin spall issued from the the production of a burin could have been selected for the manufacture of a microlith. This shifting from a category to the other is attested, for example, by the refitting of a large limestone flake (60 x 60 x 14 mm) that presents use-wear traces prior to its breakage and use as a core.

Table 8.11: Collecchio. Objectives of the production attested by core last removals.

	Class A+B	
Bladelets	53	53.0%
Laminar flakes	14	14.0%
Flakes	20	20.0%
Mix	7	7.0%
Undetermined	6	6.0%
Total	100	100%

8.5 Blanks selection and transformation

8.5.1 Microlithic armatures

For the production of microliths, laminar and flake blanks belonging to the finest quality group of raw materials (Class A) were preferably chosen (Table 8.14). They represent almost 90% of the entire assemblage. Along with bladelets and flakes, a wide set of by-products were selected. Among them (cortical) naturally backed bladelets and flakes, semi-cortical flakes and burin spalls. The frequency of such blanks could be underestimated as 68.1% of the artefacts were attributed to a generic category (bladelet/flake) because of the intense modification by retouch. Incidentally also a large retouch flake, detached in order to shape out a notch on a naturally cortical flake, was used to manufacture a crescent-like microlith.

Table 8.12: Collecchio. Number and relative position of striking platforms (ds = debitage surface).

	Class A+B	
One	50	50.0%
One +1 secondary	7	7.0%
Two opposites - same ds	11	11.0%
Two opposites - diff. ds	5	5.0%
Two opposites - same ds +1 sec.	3	3.0%
Two orthogonal - diff. ds	11	11.0%
Two orthogonal - same ds +1 sec.	1	1.0%
Three	8	8.0%
More than three	3	3.0%
Undetermined	1	1.0%
Total	100	100%

Table 8.13: Collecchio. Number and relative position of debitage surfaces.

	Class A+B	
One	53	53.0%
Two consecutive	22	22.0%
Two opposite	12	12.0%
Three or more	12	12.0%
Undetermined	1	1.0%
Total	100	100%

Almost exclusively direct retouch was used to modify these blanks. In some cases marginal inverse removals are present as secondary retouches, functional to the definition of the pointed end of the artefacts. The microburin technique is attested by very few microburins (Table 8.15) and by 4 *piquant-trièdre* on the microliths. It can, thus be surmised that it was not systematically adopted. On the contrary blanks featuring suitable morphologies were selected and exploited along the longer axis. Naturally backed bladelets are among these latter, thus corroborating the intense exploitation of core sides. Only 5 microliths were shaped out on transversal portions of flakes or large bladelets.

Totally the assemblage has yielded 14 backed points (Table 8.16; Figure 8.7). Nine of them can be considered as Sauveterre-like backed points with length spanning between 8 and 24 mm, width of 2-3 mm and thickness of 1-3 mm. Four of them present a single point, always proximal, and a single backed side, four are double pointed and three also double backed. The last one of them presents a double backing and a convex abrupt retouch along the base, conjoining the two backed sides. Five points are larger (7-13 mm) and were considered as backed points with natural base. These show a certain variability as the pointed end could be either on the proximal or distal end on the blank and the backing total or partial. One of them presents a double total backing.

Geometric microliths are represented almost exclusively by crescents. Dimensional values are 8-12 mm long, 2-4 mm wide and 1-2 mm thick. Seven of them present a

Table 8.14: Collecchio. Blanks selected for the production of microlithic armatures

	Class A		Class B	
Bladelet	10	13.9%	1	11.1%
Bladelet/flake	49	68.1%	5	55.6%
Nat. backed bladelet	1	1.4%		
Cort. backed bladelet	1	1.4%	1	11.1%
Flake	6	8.3%	1	11.1%
Nat. backed flake	1	1.4%		
Semi-cortical flake	2	2.8%		
Burin spall	1	1.4%	1	11.1%
Retouch flake	1	1.4%		
Total	72	100%	9	100%

Table 8.15: Collecchio. Wastes of the transformation phase.

	Class A		Class B	
Proximal microburins	2	20.0%		
Distal microburins	1	10.0%		
Fractured notches	3	30.0%	1	100.0%
Krukowski microburins	4	40.0%		
Total	10	100%	1	100%

complementary retouch, either partial or total. A single scalene triangle is attested.

Furthermore 3 backed and 4 backed-and-truncated bladelets/flakes are attested. Considering their irregularity these could represent pieces under construction. The number of fragments is quite high with respect to the microlith assemblage, totalling almost 60%.

8.5.2 Retouched tools

For the manufacture of retouched tools both blanks belonging to raw material classes A and B were selected. As for microliths none of them belongs to group C. Selected blanks are represented by a wide set of types, including maintenance and initialisation blanks (Table 8.17). Flakes and flake by-products are the most attested ones.

Retouched tools are more numerous than microliths (148 vs. 82) and among them burins constitute the best represented type, totaling 35% (Table 8.18; Figures 8.7; 8.8). They were manufactured on different blanks, including burin spalls, without any significant pattern. Right angle truncation burins are the most represented morphotype (15) followed by perpendicular dihedral (10) and simple ones (9). In 2 artefacts a double burin is attested.

Endscrapers are poorly represented, consisting of 3 short frontal and 3 nosed ones. All of them were manufactured from flakes and flake semi-cortical by-products.

The 19 truncations were mostly realized on laminar products and by-products, as well as on flake blanks. In half of them (10) the retouch is oblique and invasive and in 5 it presents a right angle. The other pieces feature marginal retouches, only partially modifying the natural morphology of the blanks. Retouch was generally direct but for

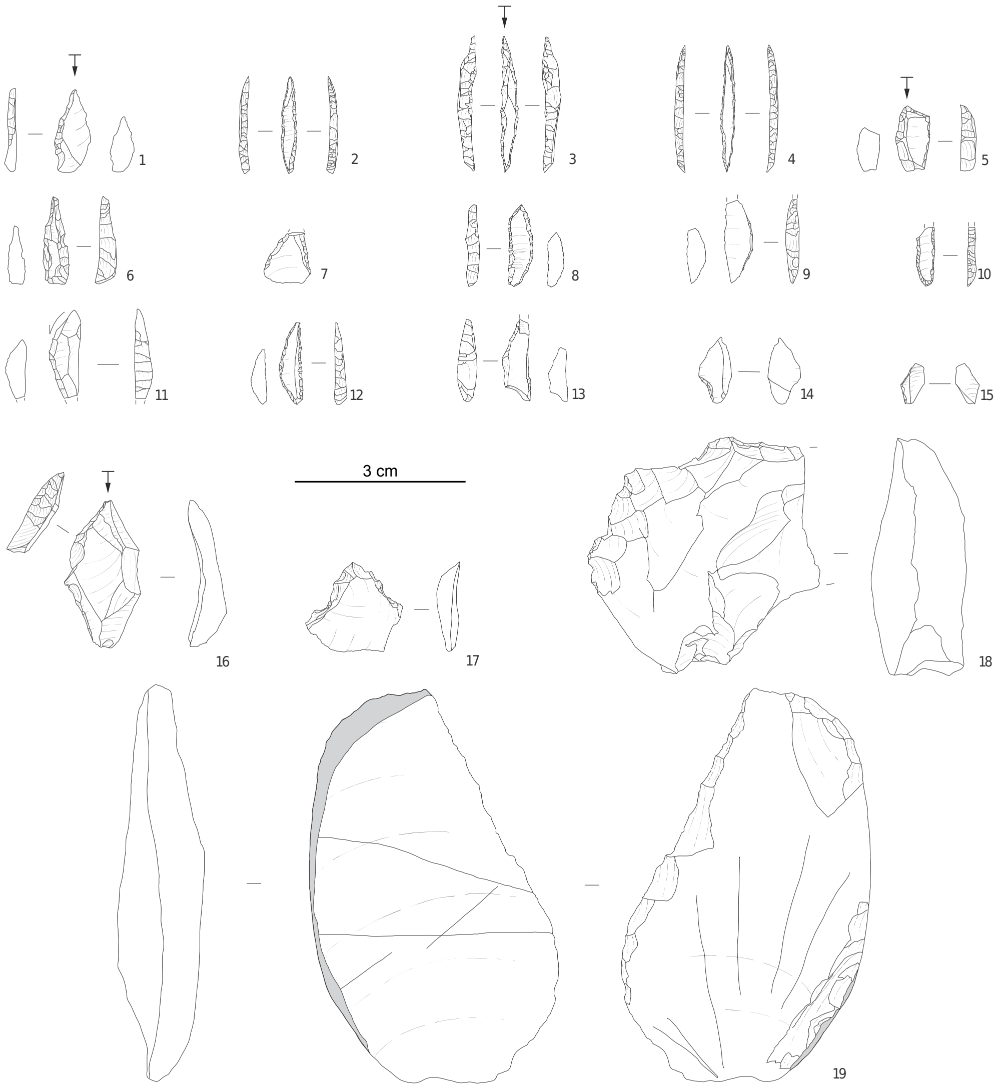

Figure 8.7: Collecchio. Lithic industry: 1, backed point with natural base; 2-4, double backed points; 5. backed-and-truncated bladelet; 6, backed point; 7, backed fragment; 8-12, crescents; 13, scalene triangle with impact fracture; 14, microburin; 15, Krukowski microburin; 16, truncation; 17-18. denticulated pieces; 19. backed flake (drawings by S. Ferrari).

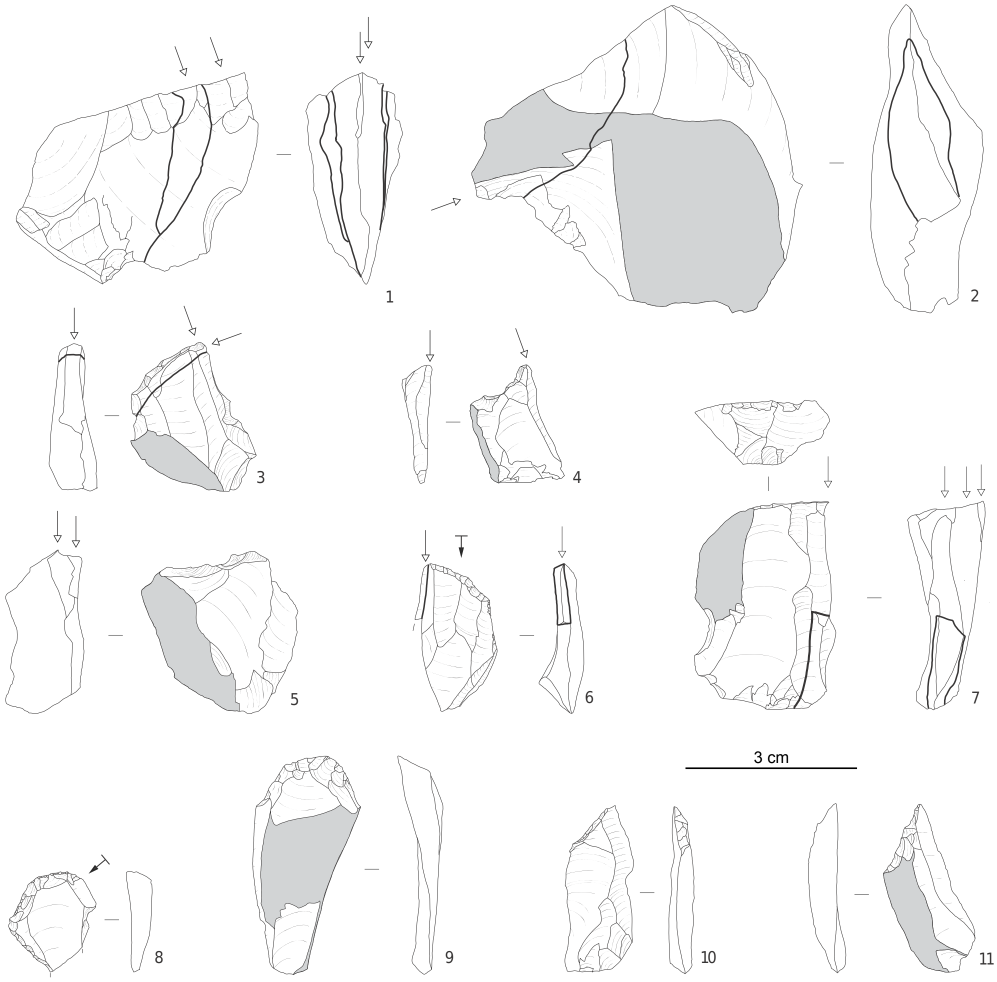

Figure 8.8: Collecchio. lithic industry: 1-2, 6-7, burins and corresponding burin spalls; 3, burin with rejuvenation; 4-5, burins; 8-9, endscrapers; 10-11, oblique truncations (drawings by S. Ferrari).

Table 8.16: Collecchio. Microlithic armatures.

	Class A+B	
Backed points	14	17.3%
Sauveterre	*9*	*11.1%*
natural base	*5*	*6.2%*
Crescents	11	13.6%
Scalene triangles	1	1.2%
Backed bladelets	3	3.7%
Backed-and-truncated bladelets	4	4.9%
Backed fragments	48	59.3%
backed fr.	*38*	*46.9%*
pointed backed fr.	*4*	*4.9%*
double backed fr.	*3*	*3.7%*
backed-and-truncated fr.	*3*	*3.7%*
Total	81	100%

Table 8.17: Collecchio. Blanks selected for the production of retouched tools.

	Class A		Class B	
Blades/bladelets	10	11.2%	3	5.6%
Laminar flake			3	5.6%
Blades/flakes	8	9.0%	1	1.9%
Flakes	17	19.1%	19	35.2%
Laminar by-products	8	9.0%	2	3.7%
Flake by-products	24	27.0%	14	25.9%
Initialisation	5	5.6%	2	3.7%
Maintenance blades	2	2.2%	1	1.9%
Maintenance flakes	5	5.6%	7	13.0%
Different	10	11.2%	2	3.7%
Total	89	100%	54	100%

one inverse truncation.

Pieces featuring marginal (9) and invasive (7) abrupt retouches are not standardized and mostly realized on flakes and (cortical) naturally backed flakes. Four of them feature an inverse retouch.

Semi-abrupt retouches were performed on flakes, laminar and flake by-products and maintenance flakes. Dimensions of selected blanks are variable (up to 64 mm long, 45 wide and 16 thick) and retouch could either be direct or inverse.

Denticulated retouches were realized on 8 artefacts, mostly flakes, either along the lateral or distal transversal edge. Isolated notches (11), on the other hand, are present on a wider set of blanks, both laminar and flake ones. Furthermore 2 artefacts, a burin spall and a flake, present traces of bipolar percussion suggesting their use as splintered pieces.

Finally 4 artefacts correspond to composite tools. In one case a burin is opposed to an endscraper, in the others a notched or denticulated edge is associated to a burin (2)

Table 8.18: Collecchio. Retouched tools.

	Class A+B	
Burins	50	35.0%
Endscrapers	6	4.2%
Truncations	19	13.3%
Backed pieces	16	11.2%
Retouched pieces	16	11.2%
Retouched fr.	11	7.7%
Denticulates	8	5.6%
Notches	11	7.7%
Splintered pieces	2	1.4%
Composite tools	4	2.8%
Total	143	100%

or to a backed side (1, fragmentary).

8.6 Use and wear

A combined low- and high-power analysis carried out by G.F.L. Berruti and S. Ziggiotti revealed the presence of 54 unretouched and 51 retouched blanks with use-wear traces (Berruti, 2008; Visentin et al., 2016a).

Unretouched blanks attest to a high variability of motions and worked materials (hard/mid-hard and soft). In 4 cases microwear referring to the same activity and material was identified in two different zones suggesting a prolonged use. Laminar products (20) and by-products (5) were mostly used with longitudinal actions on soft and mid-soft materials. In a few cases these actions were interpreted as butchery. Flakes (7) and flake by-products (6), on the other hand, were mostly used with transversal actions on mid-hard and hard materials. Incidentally initialisation of maintenance flakes were also used with a similar motion. These blanks mostly belong to the raw material class A and B. Only one opening flake and 2 semi-cortical siltstone (Class C) flakes yielded possible use-wear. Unfortunately, the poor preservation state of this raw material, did not allow to fully appreciate the aim of this peculiar production. Considering that none of the large flakes produced with this reduction scheme were retouched, it could be surmised that they were used to carry out brief tasks, possibly connected to the working of mid-hard materials as suggested by the 3 above mentioned artefacts.

Lastly a high number of burin spalls yielded use-wear traces (12). Similarly the burin assemblage yielded a good number of used artefacts (9). By combining these data with technological ones it was possible to reconstruct the utilization/modification dynamics of this tool type. As regards burins use-wear traces are located either on the lateral dihedral formed by the burin facet and the dorsal or ventral aspect of the flake, or on the truncation (if present). There is no evidence of use of the two trihedrals or of the dihedral between the two of them. In some cases use-wear traces were recognised also on the natural edges of the blank documenting the same use as that shown by the burin dihedral, a pattern confirmed by the 12 burin spalls. All of the 12 zones of use identified on the burins indicate transversal actions on mid-to-hard materials. In two of them such activity could be interpreted as wood working. Traces on the burin spalls attest a more varied set of activities as in 3 of them microwear connected to longitudinal or mixed motions on softer materials was identified. It is, thus, possible to surmise that suitable unmodified blanks were selected and directly used by exploiting their natural edges to carry out different tasks. Only later these blanks were transformed into burins (with or without preparation of a truncation) and most likely this procedure corresponds to a way of re-sharpening the tools. In one case the refitting of a burin spall allowed this functional continuity to be documented. Traces corresponding to the same action were, in fact, identified both on the truncation removed with the burin spall and on the newly obtained dihedral.

As far as the other tool types are concerned two endscrapers have yielded traces interpreted as due to hide-working; in one case ochre residues are also attested. The same traces were identified on a backed flake. Two other backed flakes yielded traces of hard materials whittling while the last one was used, on a natural edge, on animal soft tissues. Similarly three truncated bladelets were used, along their natural edges, for scraping mid-hard materials. Retouched, denticulated and notched pieces are mostly associated to transversal actions on different materials but for one retouched bladelet that was used to cut mid-soft materials. By a functional viewpoint the use-wear pattern recorded on the latter can be assimilated to that of most unretouched blanks (cf. *infra*). Finally use-wear traces were identified also on a splintered piece that functioned with a rotary motion on a soft material.

As regards microliths 20% of them yielded impact fractures (16 elements among 81). Most of them are attested on undetermined backed fragments (10), followed by 4 crescents, 1 backed-and-truncated fragment and 1 triangle. On 3 of them some traces of a longitudinal action on soft animal tissues have also been identified thus allowing to suppose that they were recycled as implements on composite cutting tools.

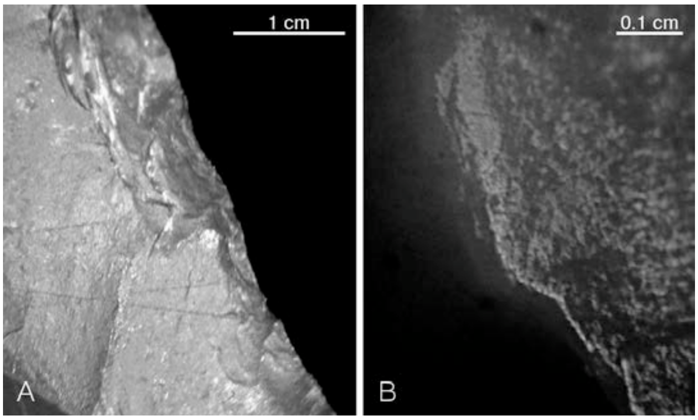

Figure 8.9: Collecchio. Micro-traces interpretable as working of wood with a transversal action identified on the truncation of a burin (photo by G.L.F. Berruti, A. magnification 65x, B. magnification 100x) (after Visentin et al., 2016a).

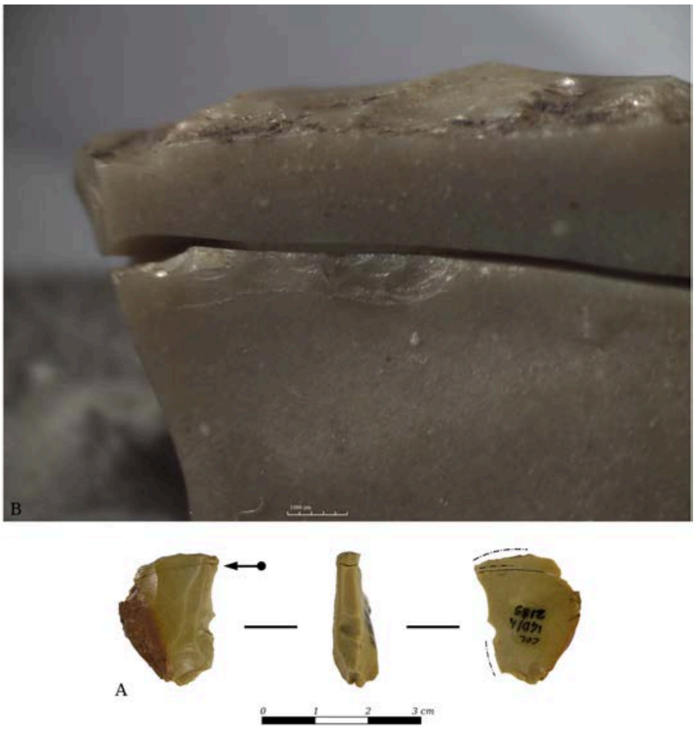

Figure 8.10: Collecchio. Refitting of a burin with its transversal burin spall (A) and detail showing use-wear traces on both of them (Photos by D. Visentin; analysis by G.L.F. Berruti) (after Visentin et al., 2016a).

Chapter 9

Rubbiano

Contents

9.1 Site introduction

The Mesolithic site of Rubbiano - Campo Barilla was identified and excavated in 2010-2011 during a rescue archaeological operation (Figure 9.1). The site is located at the confluence of the rivers Taro and Ceno, in an intravalley context, at around 156 m a.s.l. The area is characterized by a morphologic terrace oriented north-south where a reddish soil developed during the Pleistocene (attributed to the Niviano unit, around 50-40k yrs BP) (Ferrari, 2011). The discontinuous activity of the stream Ceno partially eroded the soil in correspondence of the lower sector of the terrace. The depressions thus created were afterwards filled by gravelly to silty sediments. At the end of this phase of erosion and sedimentation, a period characterized by the abundant presence of still waters followed that led to the formation of a vertisol. The Mesolithic artefacts were identified in two colluvial units deposited on the top of this soil, at the base the terrace escarpment. In particular two main Stratigraphic Units (22-23 and 60) yielded archaeological artefacts. The former is located a few dozens metres to the north of the latter. It was not possible to demonstrate whether the Mesolithic artefacts were part of the colluvium or deposited afterwards, although the former hypothesis is, more likely, the correct one. If this was the case it is probable that the settlement was originally located at the top of the terrace and not at the base of the escarpment. Similarly it is not clear if the assemblages corresponding to the 2 Stratigraphic Units were originally part of a single site or more.

Artefacts identified during the excavation were spatially positioned but sediment was not sieved (Martino and Cremona, 2011). Archaeological remains are represented by lithic artefacts and a few charcoal fragments. No other organic remains were identified.

Figure 9.1: Rubbiano - Campo Barilla. Panoramic view of the are that yielded the Mesolithic evidence (photo M.G. Cremona) (after Martino and Cremona, 2011)

9.2 Lithic assemblages

The lithic assemblage recovered during the excavation is not abundant. Totally 141 and 127 artefacts were collected respectively from Stratigraphic Unit 22-23 and 60 (Table 9.1). All the artefacts were studied and entered into the database.

Table 9.1: Rubbiano, SU 22-23, 60. Composition of the lithic assemblages.

	S.U. 22-23		S.U. 60	
Cortical and semi-cortical blanks	19	13.5%	15	11.8%
Laminar blanks	23	16.3%	13	10.2%
Flake blanks	41	29.1%	28	22.0%
Maintenance blanks	6	4.3%	6	4.7%
Burin spalls			3	2.4%
Undetermined fr.	36	25.5%	43	33.9%
Flakes < 1 cm	10	7.1%	1	0.8%
Retouched blanks	4	2.8%	7	5.5%
Transformation wastes	1	0.7%	1	0.8%
Cores	1	0.7%	10	7.9%
Total	141	100%	127	100%

As regards preservation state, the number of fragmented artefacts is relatively high (Table 9.2). Taphonomic edge scarring, on the other hand, is rather low (less than 4%). This suggests that the post-depositional processes that took place in the site, were limited to a local scale. Furthermore the imbalance between the frequency attested for some categories (e.g. cores and flakes smaller than 1 cm) seems to suggest the possible presence of sorting process that could have altered the original composition of the assemblages if not exclusively due to the excavation methodology (absence of sieving). This hypothesis, anyways, should be verified with a detailed spatial analysis. In any case the assemblages seem rather coherent, and major perturbations can reliably be excluded. The percentage of thermally altered pieces is variable, although, being attested around relatively low values for both series (Table 9.3).

Table 9.2: Rubbiano, SU 22-23, 60. Integrity of the artefacts entered into the database.

	S.U. 22-23		S.U. 60	
Entire	30	21.3%	30	23.6%
Incomplete	25	17.7%	11	8.7%
Fragments	86	61.0%	86	67.7%
Total	141	100%	127	100%

Table 9.3: Rubbiano, SU 22-23, 60. Thermal alteration of the artefacts.

	S.U. 22-23		S.U. 60	
Unaltered	97	68.8%	104	81.9%
Altered	44	31.2%	23	18.1%
Total	141	100%	127	100%

9.3 Raw material provisioning

Similarly to Collecchio, the spectrum of exploited raw materials is particularly wide both in terms of lithology and quality. The few cortical blanks indicate that provisioning took exclusively place in secondary contexts (Table 9.4). Most blanks feature sub-angular to sub-rounded edges consistent with relatively short transportation distances, within the Apennine fringe. The radiolarites of the Monte Alpe Fm, in particular, can be found on-site, in the Ceno-Taro riverbed. Less frequently cobbles could be collected in residual soils. Two artefacts present very well rounded cortical surfaces that are consistent with a long marine transportation.

As regard lithologies, mostly radiolarites and Jurassic-Cretaceous cherts were exploited (Table 9.5). The largest groups are that of the Monte Alpe radiolarites and the Maiolica/Calpionella Limestones cherts. Other sources are represented by Jurassic cherts such as Cherty Limestones and Scisti Diasprigni Fm. All of these formations outcrop in the inner part of the Northern Apennine fringe. Towards the southern Po plain (northwards) were collected the tertiary siltstones of the Antognola Fm and the cherty cobbles of the Sabbie Gialle Fm. These latter correspond to the marine gravelly sediments deposited along the Pliocene seashore, currently outcropping in the pre-Apennine terraces.

9.4 Reduction schemes

Production blanks are mostly small sized and represented by large bladelets and flakes (Table 9.6). Length values, in fact, only rarely surpass 30 mm (9 blanks). These are mostly represented by (semi-cortical) flakes in radiolarite or silicified siltstone. The maximum length value is 62 mm.

Table 9.4: Rubbiano, SU 22-23, 60. Collection context of raw material.

	S.U. 22-23		S.U. 60	
Slope deposit	9	36.0%	7	22.6%
Alluvial cobble	3	12.0%	7	22.6%
Soil			5	16.1%
Marine cobble	2	8.0%		
Undetermined	11	44.0%	12	38.7%
Total	25	100%	31	100%

Table 9.5: Rubbiano, SU 22-23, 60. Exploited lithologies.

	S.U. 22-23		S.U. 60	
Sabbie Gialle Fm.	2	1.4%		
Antognola Fm.	1	0.7%	9	7.1%
Palombini Shales	1	0.7%		
Calpionella Lm./Maiolica Fm.	32	22.7%	41	32.3%
Monte Alpe Cherts Fm.	35	24.8%	40	31.5%
Scisti Diasprigni Fm.	13	9.2%	4	3.1%
Cherty Limestone Fm.	15	10.6%	12	9.4%
Undetermined	42	29.8%	21	16.5%
Total	141	100%	127	100%

Artefacts are too few to reliably assess if a single reduction scheme was applied or more than one (as seen at Collecchio). Most of the production, anyhow, is based on the exploitation of small cobbles and fragments of blocks (up to around 60 mm). Debitage initialisation was, exclusively, direct, exploiting blank natural morphologies (Table 9.7). The flaking process proceeded by unidirectional sequences of removals, in particular as far as laminar blanks are concerned. Flakes show a higher percentage of orthogonal removals (respectively 16.7 and 10%). Debitage surfaces were mostly maintained through flake removals detached from the same striking platform (Table 9.8). Only one element attests the use of an opposite striking platform and another the preparation of a neo-crest.

9.4.1 Cores

Cores are relatively abundant with respect to the debitage blanks, at least as regards SU 60 that includes 10 of these items (Figure 9.2). They attest a prevalently lamellar production, accompanied by a mixed and flake one, present with a lesser share (Table 9.9). Three of the cores belonging to layer 6 were realized on cortical flakes and two others possibly were. Among the latter is the core of SU 22-23.

Most cores are characterized by a single striking platform and a single debitage surface (Tables 9.10 and 9.11). Less frequently more surfaces or platforms were exploited. As regards flake-cores, debitage started by exploiting the natural edges and, when prolonged, tended to became narrow frontal (burin-like cores). As for small cobbles and fragments a semi-tournant rhythm is predominant (5 out of 6). This latter are the only ones that present more that one debitage surface. Only one burin-like core

Table 9.6: Rubbiano, SU 22-23, 60. Products and by-products.

	S.U. 22-23		S.U. 60	
Main products	**52**	**68.4%**	**29**	**55.8%**
Blades	14	26.9%	8	27.6%
Laminar flakes	2	3.8%	1	3.4%
Flakes	36	69.2%	20	69.0%
Laminar by-products	**12**	**15.8%**	**6**	**11.5%**
Semi-cortical blades	2	16.7%	1	16.7%
Naturally backed blades	7	58.3%	4	66.7%
Cortical naturally backed blades	3	25.0%	1	16.7%
Flake by-products	**12**	**15.8%**	**17**	**32.7%**
Semi-cortical flake	5	41.7%	9	52.9%
Naturally backed flakes	5	41.7%	8	47.1%
Cortical naturally backed flakes	2	16.7%		
Total	76	100%	52	100%

Table 9.7: Rubbiano, SU 22-23, 60. Initialisation blanks.

	S.U. 22-23		S.U. 60	
Opening blades	1	14.3%		
Naturally crested blades	2	28.6%		
Opening flakes	1	14.3%		
Generic cortical flakes	3	42.9%	3	100.0%
Total	7	100%	3	100%

Table 9.8: Rubbiano, SU 22-23, 60. Maintenance blanks.

	S.U. 22-23		S.U. 60	
Neo-crested blades	1	16.7%		
Distal reorientation blades			1	16.7%
Reorientation flakes			1	16.7%
Surface maintenance blades	1	16.7%		
Surface maintenance flakes	1	16.7%	2	33.3%
Maintenance flakes from opposite st. platform	1	16.7%		
Generic maintenance flakes	2	33.3%	2	33.3%
Total	6	100%	6	100%

attests the ephemeral exploitation of an opposite surface from a secondary striking platform. The overhang of the striking platform was carefully abraded on 9 of the 11 attested cores.

Cores were either abandoned at the beginning (4), generally as a consequence of volumetric problems, or in the middle of their exploitation (7). None of them appears over-exploited. Main abandonment causes, if any, are represented by hinged removals (3) and volumetric problems (2).

Table 9.9: Rubbiano, SU 22-23, 60. Objective of the production attested by core last removals.

	S.U. 22-23		S.U. 60	
Bladelets			6	60.0%
Laminar flakes	1	100.0%		
Flakes			1	10.0%
Mix			2	20.0%
Undetermined			1	10.0%
Total	1	100%	10	100%

Table 9.10: Rubbiano, SU 22-23, 60. Number and relative position of striking platforms (ds = debitage surface).

	S.U. 22-23		S.U. 60	
One	1	1.0%	7	7.0%
One +1 secondary			2	2.0%
Two orthogonal - diff. ds			1	1.0%
Total	1	100%	10	100%

Table 9.11: Rubbiano, SU 22-23, 60. Number and relative position of debitage surfaces.

	S.U. 22-23		S.U. 60	
One	1	1.0%	6	6.0%
Two consecutive			3	3.0%
Two opposite			1	1.0%
Total	1	100%	10	100%

9.5 Blanks selection and transformation

The number of blanks that were retouched is very low, respectively 4 for SU 22-23 and 7 for SU 60. Totally, 6 of them are microliths and 5 retouched tools (Table 9.12 and 9.13).

Among the former the only backed point is represented by a backed point with natural base belonging to SU 60. It was manufactured on a radiolarite flake by

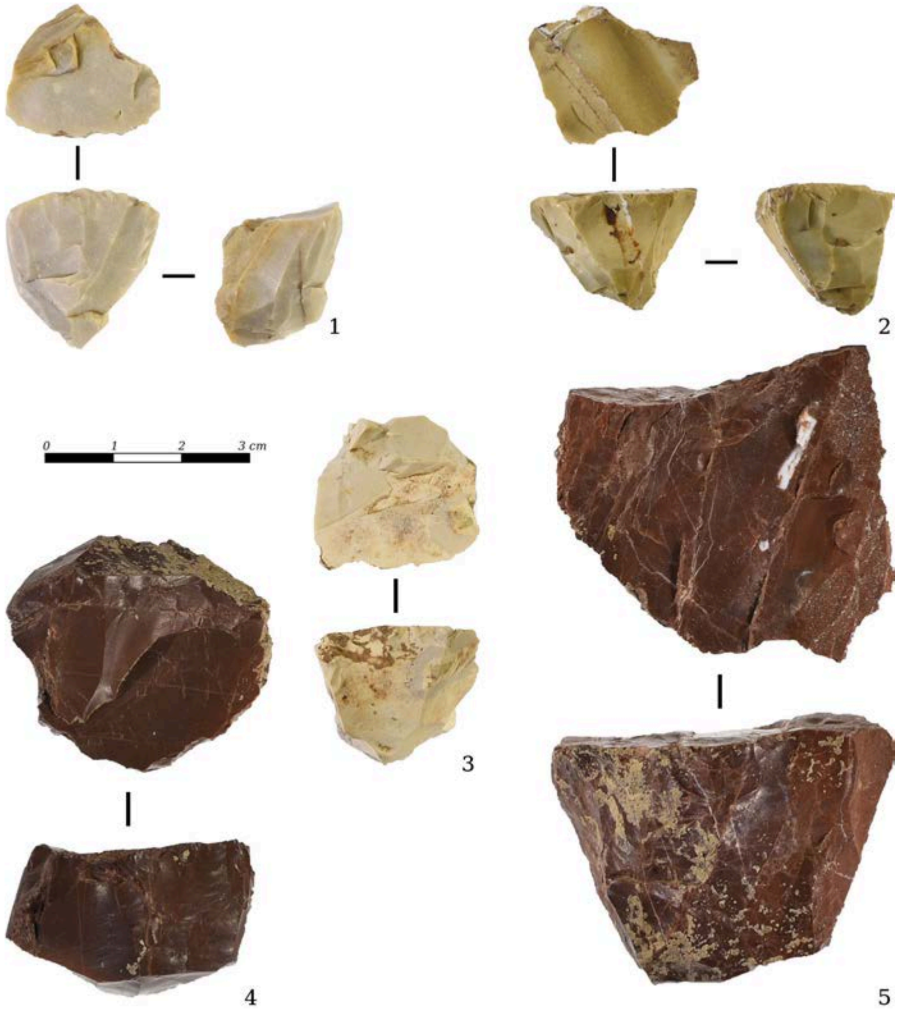

Figure 9.2: Rubbiano - Campo Barilla. Cores: 1-3, chert; 4-5, radiolarite; 1-2,4-5, S.U. 60; 3, S.U. 22.

means of a distal direct abrupt retouch. The 3 scalene triangles are all small sized (maximum dimensions are 11 x 4 x 2 mm). All three of them present a backed third side. Additionally an isosceles trapeze was recovered in the assemblage belonging to SU 60. It was manufactured on a large bladelet by performing two oblique truncations. No remains of a piquant-trèdre are visible. This artefact shows evident impact traces both on the small and the large bases suggesting its transversal hafting. Considering the blank morphology, that presents no direct term of comparison with the remaining partof the assemblage this item should probably be considered as out of context. In both assemblages there is no evidence of the use of the microburin technique. The only transformation wastes are represented by two retouch flakes (Table 9.1).

Among retouched tools belonging to SU 22-23, a scraper and a retouched bladelet are attested. Both of them are realized with the radiolarite. The former one was manufactured on a large flake and presents lateral retouches. Retouched tools identified in the assemblage of SU 60 are represented by a borer and two retouched fragments. The former was manufactured on a large radiolarite naturally backed flake. One among the two fragments presents a bifacial retouch realized on a large silicified siltstone flake.

Table 9.12: Rubbiano, SU 22-23, 60. Microlithic armatures.

	S.U. 22-23		S.U. 60	
Backed points			1	25.0%
natural base			*1*	*25.0%*
Scalene triangles	1	50.0%	2	50.0%
Isosceles trapezes			1	25.0%
Backed fragments	1	50.0%		
backed fr.	*1*	*50.0%*		
Total	2	100%	4	100%

Table 9.13: Rubbiano, SU 22-23, 60. Retouched tools.

	S.U. 22-23		S.U. 60	
Endscrapers	1	50.0%		
Borers			1	33.3%
Retouched pieces	1	50.0%		
Retouched fr.			2	66.7%
Total	2	100%	3	100%

Figure 9.3: Rubbiano - Campo Barilla. Lithic industry: 1, backed point with natural base; 2-4 triangles; 5, retouched piece; 6, borer (S.U. 60); 7, endscraper; 8, triangle; 9, backed fragment (S.U. 22).

Chapter 10

Longaròla

Contents

10.1 Site introduction

In 2001, during the work for the construction of a pipeline between Parma and Pontremoli, some chert artefacts were identified along the watershed separating the Parma and Baganza valleys at Longaròla, a locality on Mount Montagnana (Parma, Emilia Romagna) at an altitude of around 1300 m a.s.l. (De Marchi, 2003). The find-spot corresponds to a flattish area located along the ridge, just under the mountaintop and developed northeast-to-southwest. Here some artefacts had already been identified in 1993. A rescue excavation, thus, was started and covered an area of 932 square meters that was divided according to a reference grid of 1 metre. The operation was conducted by Gea snc (Parma). Unfortunately the most superficial levels had already been removed by the pipeline construction works. In the southern and central sectors of the excavation numerous Stratigraphic Units were identified, most of which included only a few lithic artefacts and potsherds. Only in two of them the number of lithic artefacts was conspicuous: Stratigraphic Units 3 and 14. The former was identified in the central sector and basically corresponds to the illuvial horizon of a paleosol. Sediment is characterized by a yellowish brown colour and a silty-loamy texture. Towards the bottom the clay rate increases and it assumes a vertic aspect. Lithic artefacts were mostly located at the top of the layer (first 5 cm) and in particular at the interface with the upper level 2. Layer 14, on the other hand, was interpreted as a colluvium of clayish-silty sediments. Lithic artefacts were identified only in its southern portion. This level is reported to cover a paleosurface with lithics and combustion structures. Unfortunately the unavailability of any graphic documentation concerning the excavation does not allow their attribution to the Sauveterrian occupation of the site as well as that of other smaller structures and layers. In both layers a few small potsherds were found, probably as a consequence of post depositional process (2 in layer 3 and 5 in layer 15).

The entire lithic assemblage was initially studied by V. Balboni (2014) in the framework of a bachelor thesis (Laurea triennale) supervised by F. Fontana and co-supervised by myself. The description of every artefact was reviewed and verified personally.

10.2 Lithic assemblages

In this work exclusively the lithic assemblages belonging to Stratigraphic Unit 3 and 14 will be considered, being the only ones composed by a significant number of artefacts, respectively 155 and 544 (Table 10.1), allowing their attribution to the Sauveterrian.

Table 10.1: Longaròla - Mt. Montagnana, SU 3, 14. Composition of the lithic assemblages.

	S.U. 3		S.U. 14	
ortical and semi-cortical blanks	12	7.7%	40	7.4%
Laminar blanks	25	16.1%	94	17.3%
Flake blanks	35	22.6%	109	20.0%
Maintenance blanks	15	9.7%	28	5.1%
Burin spalls			5	0.9%
Undetermined fr.	39	25.2%	180	33.1%
Flakes < 1 cm	10	6.5%	69	12.7%
Retouched blanks	10	6.5%	13	2.4%
Transformation wastes	4	2.6%		
Cores	5	3.2%	6	1.1%
Total	155	100%	544	100%

At a general level all classes of artefacts are well represented, even flakes smaller than 1 cm attesting to a detailed collection of the lithic assemblage although information regarding the sieving of the sediment are absent. Mechanical damages, on the other hand, are widespread and the larger part of the artefacts are fragmentary (Table 10.2). The presence of thermal alteration is reduced to respectively 11% and 17.6% of the assemblage (Table 10.3).

Table 10.2: Longaròla - Mt. Montagnana, SU 3, 14. Integrity of the artefacts entered into the database.

	S.U. 3		S.U. 14	
Entire	26	17.3%	93	17.3%
Incomplete	11	7.3%	50	9.3%
Fragments	113	75.3%	395	73.4%
Total	150	100%	544	100%

Table 10.3: Longaròla - Mt. Montagnana, SU 3, 14. Thermal alteration of the artefacts.

	S.U. 3		S.U. 14	
Unaltered	138	89.0%	448	82.4%
Altered	17	11.0%	96	17.6%
Total	155	100%	544	100%

10.3 Raw material provisioning

As regards lithic raw material provisioning, the evidence of the site shows strong similarities with Collecchio and Rubbiano, as expected on the base of the geographical proximity. The analysis of cortical surfaces shows that provisioning took exclusively place in secondary contexts, mostly not far from the outcrops (Table 10.4). Collected cobbles and blocks were probably small sized (no more than 70-40 mm). Similarly to Rubbiano, some marine cobbles, with well rounded edges were also collected in the pre-Apennine fringe (Sabbie Gialle Fm). From a lithological point of view chert and radiolarites were preferentially exploited along with few partially silicified limestones and siltstones. In particular Jurassic and Cretaceous formations belonging to the Internal Ligurids (Monte Alpe Chert Fm, Calpionella Limestones, Palombini Shales) and Umbro-Tuscan units (Cherty Limestones, Scisti Diasprigni, Maiolica) were exploited along with tertiary ones such as the Monte Sporno Flysh (External Ligurid unit) and the Antognola formation (Epiligurid unit). The composition of the 2 assemblages is similar but for the presence of flysh, much more common in SU 3.

Table 10.4: Longaròla - Mt. Montagnana, SU 3, 14. Collection context of raw material.

	S.U. 3		S.U. 14	
Slope deposit	14	43.8%	40	52.6%
Alluvial cobble			3	3.9%
Marine cobble	4	12.5%	5	6.6%
Undetermined	14	43.8%	28	36.8%
Total	32	100%	76	100%

10.4 Reduction schemes

In both Stratigraphic Units a single reduction scheme is attested. This was devoted to the exploitation of small blocks and cobbles for obtaining bladelet and flakes (Table 10.6).

10.4.1 Initialisation

Initialisation blanks are represented by a small group of artefacts (Table 10.7). As far as Stratigraphic Unit 3 is concerned they are exclusively represented by flake blanks. In layer 14, these are associated to laminar elements, in particular exploiting natural crests. Only in one case a crest-like blade was shaped out.

Table 10.5: Longaròla - Mt. Montagnana, SU 3, 14. Exploited lithologies.

	S.U. 3		S.U. 14	
Sabbie Gialle Fm.	11	7.1%	31	5.7%
Antognola Fm.			9	1.7%
Monte Sporno Flysh	38	24.5%	40	7.4%
Palombini Shales	10	6.5%	25	4.6%
Calpionella Lm./Maiolica Fm.	39	25.2%	215	39.5%
Monte Alpe Cherts Fm.	13	8.4%	44	8.1%
Scisti Diasprigni Fm.	8	5.2%	47	8.6%
Cherty Limestone Fm.	14	9.0%	21	3.9%
Undetermined	22	14.2%	112	20.6%
Total	155	100%	544	100%

10.4.2 Production

The main products are represented by wide bladelets, mostly featuring a triangular cross-section, and flakes. Estimating production dimensional values is difficult considering the high number of fragmentary artefacts. In particular as far as SU 3 is concerned data reported in Table 10.8 cannot be considered statistically reliable. Half of the bladelets belonging to SU 14 have length values spanning between 16 and 29 mm, and they do not surpass 47 mm (Table 10.8, Figure 10.1). Flakes are generally smaller, with a mean length value inferior to 20 mm. All products are generally flaked through unidirectional sequences of removals. As far as lamellar blanks are concerned also bidirectional removals are consistently attested (respectively 13.3% and 4.7% for bladelets and 33.3% and 12.5% for laminar by-products). It is more likely that these are connected to reorientation of the cores on the same surface, possibly at the occurrence of knapping errors, than to an actual bidirectional exploitation. Among surface maintenance elements, in fact, those detached from an opposite striking platform are relatively abundant (Table 10.9). Orthogonal reorientation blanks, on the other hand, are represented only by a flake and a bladelet. A good share of surface and undetermined maintenance flakes present orthogonal removals. In two cases, both belonging to layer 14, a partial neo-crest was shaped out.

The analysis of attributes connected to the identification of knapping techniques supports a direct percussion with a soft hammerstone. On around 50% of the laminar blanks and of the flakes the overhang of the striking platform was trimmed, while this percentage decreases to 28.6% on flake by-products (SU 14).

10.4.3 Cores

The number of cores is not high. SU 3 yielded 5 cores and SU 14, 6 (Figure 10.2). These attest lamellar and flake productions along with mixed ones (Table 10.10). Only two cores were manufactured on a flake while in other cases blanks are represented by cobbles and small blocks.

All the cores of SU 14 present a single striking platform and debitage surface (Tables 10.11 and 10.12). SU 3, on the other hand, attests a higher variability in terms of applied solutions in particular concerning multiple reorientation of the cores and exploitation of numerous platforms and surfaces (2). Debitage surfaces mostly attest wide frontal and semi-tournant flaking modalities. Only one, corresponding to the

Table 10.6: Longaròla - Mt. Montagnana, SU 3, 14. Products and by-products.

	S.U. 3		S.U. 14	
Main products	**39**	**57.4%**	**163**	**71.5%**
Blades	11	28.2%	59	36.2%
Laminar flakes	4	10.3%	26	16.0%
Flakes	24	61.5%	78	47.9%
Laminar by-products	**12**	**17.6%**	**16**	**7.0%**
Semi-cortical blades	2	16.7%	6	37.5%
On the edge blades	1	8.3%		
Semi-cortical on the edge blades			1	6.3%
Naturally backed blades	6	50.0%	5	31.3%
Cortical naturally backed blades	3	25.0%	4	25.0%
Flake by-products	**17**	**25.0%**	**49**	**21.5%**
Semi-cortical flake	6	35.3%	18	36.7%
Naturally backed flakes	8	47.1%	17	34.7%
Cortical naturally backed flakes	3	17.6%	14	28.6%
Total	68	100%	228	100%

Table 10.7: Longaròla - Mt. Montagnana, SU 3, 14. Initialisation blanks.

	S.U. 3		S.U. 14	
Crested blades			1	6.7%
Opening blades			1	6.7%
Naturally crested blades			3	20.0%
Opening flakes	1	25.0%	6	40.0%
Generic cortical flakes	3	75.0%	4	26.7%
Total	4	100%	15	100%

Table 10.8: Longaròla - Mt. Montagnana, SU 3, 14. Summary of the metric values of debitage products and by-products (A = blades, B = laminar by-products, C = flakes, D = flake by-products).

		S.U. 3				S.U. 14			
		A	B	C	D	A	B	C	D
Length	Min.	14	12	12	14	11	16	7	10
	1st Qu.	16.75	25	13.5	14	16	18	11	13.25
	Median	19.5	29	16	17	21	20	15	16
	Mean	19.5	27.43	19	18	23.64	23.45	17.71	19
	3rd Qu.	22.25	32	21.5	19	29	28	20	23.75
	Max.	25	37	32	26	47	39	70	42
	σ	7.78	8.28	9.02	4.95	9.72	7.33	11.34	7.94
	Count	2	7	4	5	25	11	35	30
Width	Min.	5	3	4	7	2	5	4	5
	1st Qu.	8	8.5	9	14	6	6.75	8	9
	Median	10	11	12	16	8	8	10.5	12
	Mean	10.53	10.73	11.95	16.13	9.15	9.31	12.36	12.63
	3rd Qu.	12	13.5	13	18.5	11	10.25	14	14
	Max.	22	17	24	27	28	19	51	35
	σ	4.16	4.2	4.34	4.41	4.76	4.05	7.27	5.66
	Count	15	11	21	15	82	16	72	48
Thickness	Min.	1	2	1	1	1	2	1	1
	1st Qu.	2	3	1	3	2	2	2	2
	Median	2	3	2	4	2	3.5	2	3
	Mean	2.73	5	2.25	4.76	2.27	4.38	2.99	4
	3rd Qu.	3.5	5.25	3	6	2	4	3.75	5
	Max.	5	14	7	12	8	19	16	15
	σ	1.44	3.72	1.42	2.97	1.37	4.13	2.17	2.8
	Count	15	12	24	17	85	16	78	49

Table 10.9: Longaròla - Mt. Montagnana, SU 3, 14. Maintenance blanks.

	S.U. 3		S.U. 14	
Partially neo-crested blades			2	7.1%
Proximal reorientation blades	1	6.7%		
Reorientation flakes			1	3.6%
Surface maintenance blades	1	6.7%		
Naturally backed surface maintenance bl.			1	3.6%
Surface maintenance flakes	4	26.7%	5	17.9%
Maintenance flakes from opposite st. pl.	2	13.3%	5	17.9%
Striking platform maintenance flakes	1	6.7%	2	7.1%
Generic maintenance flakes	6	40.0%	12	42.9%
Total	15	100%	28	100%

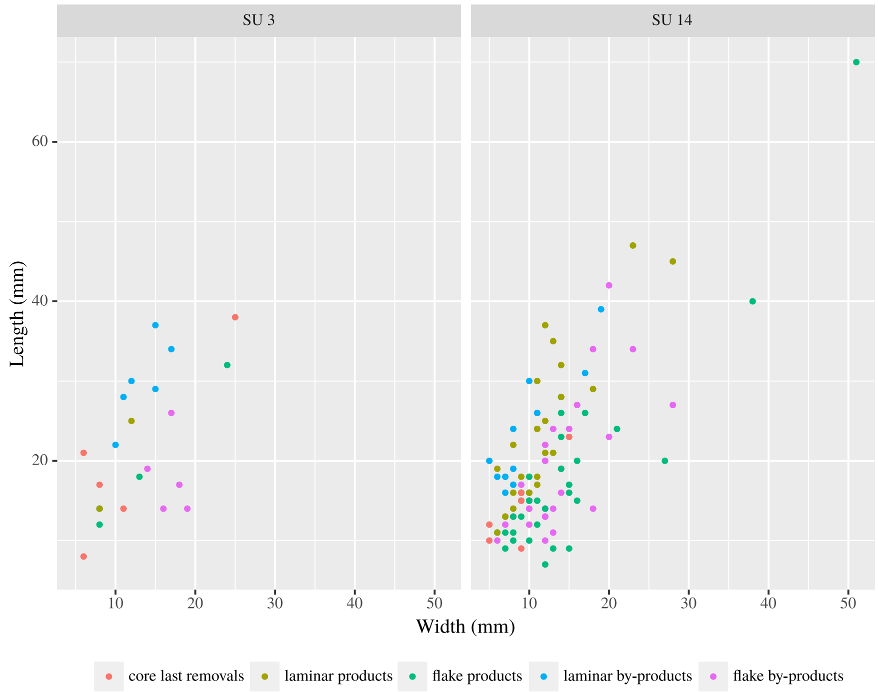

Figure 10.1: Longaròla - Mt. Montagnana, SU 3, 14. Scatterplot of length and width values of products, by-products and core last removals.

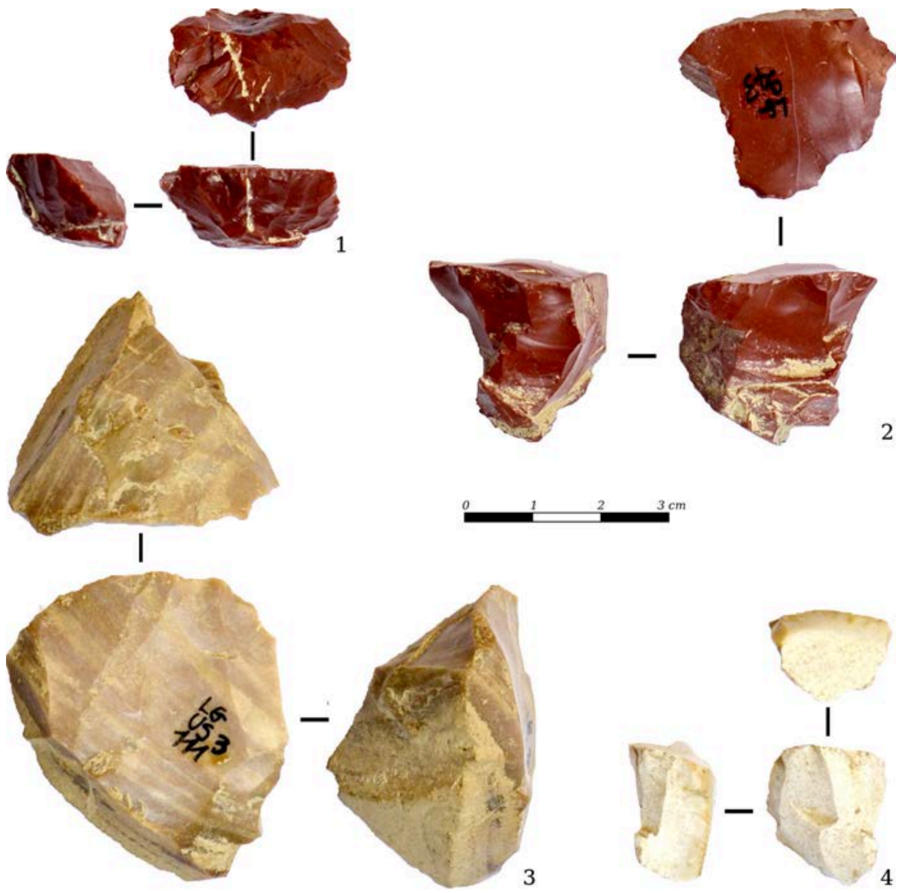

Figure 10.2: Longaròla - Mt. Montagnana, SU 3, 14. Cores (photo V. Balboni).

core realized on a flake, was exploited along the edge as a burin-like core (SU 3). In the other flake-cores, the striking platform was established on the ventral surface and debitage proceeded unidirectionally, with a semi-tournant rhythm (endscraper-like core).

Cores attest different exploitation stages. One of them can be considered a tested-cobble, while the others were abandoned at the beginning (3), during (4) or after a long exploitation (3). In most cases the abandonment is due to the presence of hinged removals on the debitage surfaces.

Table 10.10: Longaròla - Mt. Montagnana, SU 3, 14. Objectives of the production attested by cores.

	S.U. 3		S.U. 14	
Bladelets	2	40.0%		
Laminar flakes			2	33.3%
Flakes	1	20.0%		
Mix	1	20.0%	2	33.3%
Undetermined	1	20.0%	2	33.3%
Total	5	100%	6	100%

Table 10.11: Longaròla - Mt. Montagnana, SU 3, 14. Number and relative position of striking platforms (ds = debitage surface).

	S.U. 3		S.U. 14	
One	1	20.0%	6	100.0%
One +1 secondary	1	20.0%		
Two orthogonal - diff. ds	1	20.0%		
More than three	2	40.0%		
Total	5	100%	6	100%

Table 10.12: Longaròla - Mt. Montagnana, SU 3, 14. Number and relative position of debitage surfaces.

	S.U. 3		S.U. 14	
One	2	40.0%	6	100.0%
Two consecutive	1	20.0%		
Three or more	2	40.0%		
Total	5	100%	6	100%

10.5 Blanks selection and transformation

Also the number of retouched artefacts is low, in particular as far as microliths are concerned (Table 10.13). SU 3 yielded a scalene triangle and a microlith that was probably abandoned during the manufacturing of a double back. Both of them are small sized. The triangle (9 x 3 x 1 mm) is a scalene type and features a marginal abrupt complementary retouch on the third side. On the main tip a small bending fracture is present. Additionally four microburins are attested, 3 proximal and 1 distal. SU 14 yielded one elongated double backed point, fragmentary on the apical part. Its measures are 10 x 2 x 1 mm and it presents a continuous retouch on the two sides forming a convex blunt morphology in correspondence of the preserved base. The two triangles are both scalene and small sized (7 x 2 x 1 mm and 10 x 3 x 1). One of them features a third backed side and the other a partial semi-abrupt retouch.

Table 10.13: Longaròla - Mt. Montagnana, SU 3, 14. Microlithic armatures.

	S.U. 3		S.U. 14	
Backed points			1	20.0%
Sauveterre			*1*	*20.0%*
Scalene triangles	1	50.0%	2	40.0%
Backed fragments			2	40.0%
pointed backed fr.			1	20.0%
backed-and-truncated fr.			1	20.0%
Under construction	1	50.0%		
Total	2	100%	5	100%

For the production of retouched tools mostly flake blanks were selected, among which maintenance elements are also attested (Table 10.14). Differently from Collecchio for all of them well silicified blanks were preferred. Both Stratigraphic Units are characterized by a similar structure in terms of attested types (Table 10.15). The two endscrapers were manufactured on flakes with a frontal retouch. The four truncations were manufactured on elongated blanks but for one cortical naturally backed flake. Retouch is always direct and generally oblique, either complete or partial. One of them presents two oblique truncations on the opposite ends of the tool. Irregular abrupt retouches were performed on different blanks, mostly (naturally cortical) flakes. The same can be said for pieces featuring semi-abrupt retouches. One among them (SU 3) was probably a sort of borer, although, being fragmentary, it cannot be ascertained. Retouch is mostly direct (only in one case inverse), either invasive or marginal and distributed either on one of the lateral edges or on the distal one. Furthermore three isolated notches were shaped on a laminar flake, a flake and a maintenance flake.

Table 10.14: Longaròla - Mt. Montagnana, SU 3, 14. Blanks selected for the production of retouched tools.

	S.U. 3		S.U. 14	
Blades/bladelets	2	25.0%		
Laminar flakes			2	25.0%
Blades/flakes	1	12.5%	1	12.5%
Flakes	3	37.5%	2	25.0%
Flake by-products	1	12.5%	2	25.0%
Maintenance flakes	1	12.5%		
Different			1	12.5%
Total	8	100%	8	100%

Table 10.15: Longaròla - Mt. Montagnana, SU 3, 14. Retouched tools.

	S.U. 3		S.U. 14	
Endscrapers	1	12.5%	1	12.5%
Truncations	2	25.0%	2	25.0%
Backed pieces	1	12.5%	1	12.5%
Backed fr.	1	12.5%	1	12.5%
Retouched pieces			1	12.5%
Retouched fr.	1	12.5%	1	12.5%
Notches	2	25.0%	1	12.5%
Total	8	100%	8	100%

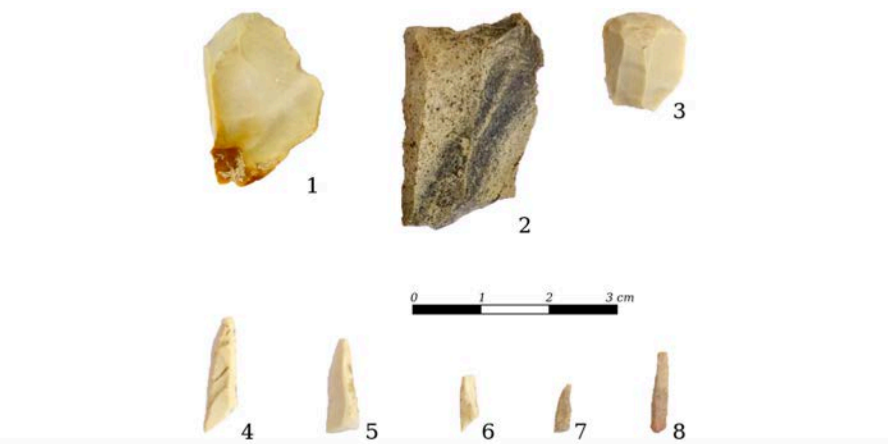

Figure 10.3: Longaròla - Mt. Montagnana, SU 3 (1, 2, 5), 14 (3, 6-8). Lithic industires: 1, 3, endscrapers; 2, truncation; 4-7, triangles; 8, backed-and-truncated fragment (photo V. Balboni). Artefact n. 4 was collected out of context.

Chapter 11

Casalecchio

Contents

11.1 Site introduction

The site of Casalecchio di Reno (Figure 11.1) was identified in 1998 during a rescue excavation. It is located at 59 m a.s.l., on the proximal part of the alluvial fan of the river Reno, very close to the hilly band of the Apennines, just westwards of Bologna (Fontana et al., 2009b; Fontana and Visentin, 2016). The Early Mesolithic deposit was identified about 2 m under the present soil. Excavation continued until 1999 and allowed bringing to light a lithic assemblage of more than one thousand artefacts along with some burnt bone fragments. Totally a surface of around 40 square metres was investigated (Fontana et al., 2009a). During the excavation artefacts were attributed to a 1 m square grid. All the sediments were sieved using meshes with 2 mm openings.

Previous studies of the lithic assemblage (Fontana and Cremona, 2008; Fontana et al., 2009a,b) allowed interpreting the site as a short-term hunting camp. The spatial analysis of the distribution of the lithic assemblage allowed identifying two main clusters, both including a latent fire-structure (Visentin and Fontana, 2016).

Unfortunately no radiocarbon date is available for the site. On the base of the techno-typological characteristics of the lithic assemblage, a possibly Boreal age was proposed (Fontana et al., 2013; Fontana and Visentin, 2016).

11.2 Lithic assemblages

The lithic assemblage is composed of 1101 artefacts (Table 11.1). All of them were analysed from a techno-typological point of view and entered into the database. It

Figure 11.1: Casalecchio di Reno. The site under excavation (photo D. Mengoli).

should be specified that the technological study of this site had already been started by F. Fontana using an older version of the database and that in the present work it was only partially reviewed in order to respect the methodological framework and homogenize data presentation.

Table 11.1: Casalecchio. Composition of the lithic assemblage.

Cortical and semi-cortical blanks	122	11.1%
Laminar blanks	168	15.3%
Flake blanks	142	12.9%
Maintenance blanks	55	5.0%
Undetermined fr.	490	44.5%
Flakes $<$ 1 cm	58	5.3%
Retouched blanks	51	4.6%
Transformation wastes	1	0.1%
Cores	14	1.3%
Total	1101	100%

The number of fragmentary artefacts is quite high, corresponding to 65% of the assemblage (Table 11.2). Minor and marginal fractures, on the other hand, are much less attested. Also the number of thermally altered artefacts is uncommonly low (12.4%; Table 11.3), in particular considering the presence of two fire structures on the site.

Table 11.2: Casalecchio. Integrity of the artefacts entered into the database.

Entire	318	28.9%
Incomplete	67	6.1%
Fragments	716	65.0%
Total	1101	100%

Table 11.3: Casalecchio. Thermal alteration of the artefacts.

Unaltered	965	87.6%
Altered	136	12.4%
Total	1101	100%

11.3 Raw material provisioning

As regards lithic raw materials, procurement was essentially local. All the exploited lithologies can be found in secondary deposition on the terraces of the Apennine fringe. At a general level raw materials can be grouped into two main assemblages corresponding to well silicified cherts and (partially) silicified siltstones. The former are represented by well rounded cobbles, deposited in the Pliocene shores (Sabbie Gialle Fm) (Table 11.4). The lithological variability of this resource is particularly high including both exceptionally good and fine cherts belonging to the Umbria-Marches basin and slightly coarser varieties. The average size of chert pebbles in this sector of the Northern Apennines is around 50 mm in diameter. Along with these small cobbles, larger blocks of a silicified siltstone, locally known as "ftanite", were also collected. The exact geological formation these raw materials belong to is still uncertain but an association with the local tertiary lithologies can be proposed. Primary outcrops of these materials are, in fact, still unknown. They are easily identifiable and collectable in secondary depositions on the already mentioned terraces. In this case, blocks were not deposited by the marine transportation as in the case of the cherty pebbles, but by the rivers and streams activity. Their size is much larger, often more than 10 cm, and their edges appear rounded to sub-rounded but the general morphology is quite irregular. Most o blocks present a good degree of silicification although the exploitation of a low silicified variety is attested by 17 artefacts.

Additionally a single radiolarite flake was identified (included in the chert assemblage).

Table 11.4: Casalecchio. Exploited lithologies.

Sabbie Gialle Fm.	703	63.9%
Silicified siltstones	397	36.1%
Radiolarites	1	0.1%
Total	1101	100%

11.4 Reduction schemes

Lithic raw materials were exploited according to 2 main reduction schemes. The former was dedicated to the flaking of the cherty pebbles and aimed at obtaining bladelets and flakes generally smaller than 40 mm (Table 11.5). The second one was adapted to the larger siltstone blocks and had a double objective: at first the obtention of a few large laminar flakes (60-100 mm long), secondly a smaller sized production comparable to that of the first scheme.

Table 11.5: Casalecchio. Products and by-products.

	Chert		Siltstone	
Main products	**180**	**60.6%**	**80**	**80.8%**
Blades	88	48.9%	33	41.3%
Laminar flakes	6	3.3%	6	7.5%
Flakes	86	47.8%	41	51.3%
Laminar by-products	**51**	**17.2%**	**10**	**10.1%**
Semi-cortical blades	24	47.1%	2	20.0%
Naturally backed blades	18	35.3%	7	70.0%
Cortical naturally backed blades	9	17.6%	1	10.0%
Flake by-products	**66**	**22.2%**	**9**	**9.1%**
Semi-cortical flake	55	83.3%	5	55.6%
Naturally backed flakes	4	6.1%	2	22.2%
Cortical naturally backed flakes	7	10.6%	2	22.2%
Total	297	100%	99	100%

11.4.1 Initialisation

As regards the first reduction scheme, cortical flakes were detached from the pebbles, mainly along their smaller side, in order to create a striking platform. Debitage was then directly started by means of cortical blades and flakes, exploiting the transversal and longitudinal natural convexities. As suggested by one of the cores, bipolar percussion could be alternatively used for opening the pebbles.

Siltstone initialisation blanks are few (Table 11.6) and thus the debitage initialisation is difficult to reconstruct. Tentatively a modality similar to that of smaller pebbles could be proposed, that is the opening of a striking platform followed by the flaking of large cortical and semi-cortical flakes.

Table 11.6: Casalecchio. Initialisation blanks.

	Chert		Siltstone	
Opening blades	4	14.8%		
Opening flakes	6	22.2%	3	33.3%
Generic cortical flakes	17	63.0%	6	66.7%
Total	27	100%	9	100%

11.4.2 Production

In the first reduction scheme the flaking process was aimed at obtaining a single dimensional group of objectives, represented by both bladelets and flakes. As regards bladelets the maximum length value attested is 43 mm (Table 11.7; Figure 11.2) and half of them are comprised between 12 and 20 mm. Flakes are generally shorter. Debitage is essentially unidirectional and proceeds with a *semi-tournant* or frontal modality. Occasionally cores were turned orthogonally as attested by some flakes (Table 11.8). Other maintenance blanks are represented by a few neo-crested blades and surface maintenance flakes. A few among these latter were detached from an opposite striking platform. Two flakes attest that, sporadically, also striking platforms were rejuvenated.

The exploitation of the silicified siltstones was aimed at initially obtaining a few large laminar flakes or cortical naturally backed flakes. During this phase, flaking was not systematic and, probably, the core volumetry was opportunistically exploited. Blanks belonging to this phase are underrepresented in the current lithic assemblage. One of the siltstone cores was abandoned at the end of this stage; otherwise cores continued to be exploited in order to obtain products of size and morphology comparable to those of the chert production. For this aim also fragments and flakes previously obtained could be used as cores. Also in this case debitage was preferentially unidirectional. With respect to chert pebbles, maintenance of siltstone cores was reduced to a minimum.

For both reduction schemes the direct percussion with a soft hammerstone was, probably, adopted. In the chert assemblage the overhang was trimmed in the majority of laminar products and by-products (62-54%), a little less frequently in flake ones (44%). As regards siltstone artefacts, only main products (78-76%) and laminar by-products (66%) present a trimmed overhang while flake by-products only rarely (20%).

Table 11.7: Casalecchio. Summary of the metric values of debitage products and by-products (A = blades, B = laminar by-products, C = flakes, D = flake by-products).

		Chert				Siltstone			
		A	B	C	D	A	B	C	D
Length	Min.	10	11	6	10	11	16	8	14
	1st Qu.	12	18	11	13.5	18.75	18.25	13	28
	Median	15.5	20.5	13	18	29	25	19	40
	Mean	17.56	23.25	13.75	19.13	36.11	41.5	20.85	45.2
	3rd Qu.	20.5	27	15.5	22.5	37.5	55.75	26.25	48
	Max.	43	62	30	41	91	101	41	96
	σ	7.92	9.38	4.44	6.92	25.7	34.37	8.85	31.16
	Count	34	32	67	39	18	6	40	5
Width	Min.	3	4	5	6	4	7	8	15
	1st Qu.	5	7	8	12	9	8.5	12	16.5
	Median	7	10	9	15	12	11	14	24
	Mean	7.14	10.24	10.26	15.71	15.05	16.8	18.08	28.38
	3rd Qu.	9	12	13	19	18.5	13.5	22	31.75
	Max.	18	34	20	37	44	55	44	65
	σ	3.08	4.81	3.55	6.37	10.13	15.41	8.91	16.97
	Count	94	51	77	58	39	10	39	8
Thickness	Min.	1	1	1	1	1	3	1	3
	1st Qu.	1	2	1	3	1	3	2	5
	Median	1	3	2	3	2	5	2.5	5
	Mean	1.52	3.53	2.15	4.28	3.41	6.2	3.2	7.78
	3rd Qu.	2	4	3	6	4	6.75	4	10
	Max.	7	18	8	11	13	14	9	20
	σ	0.9	2.52	1.4	2.24	3.03	4.1	1.98	5.43
	Count	94	51	85	61	39	10	40	9

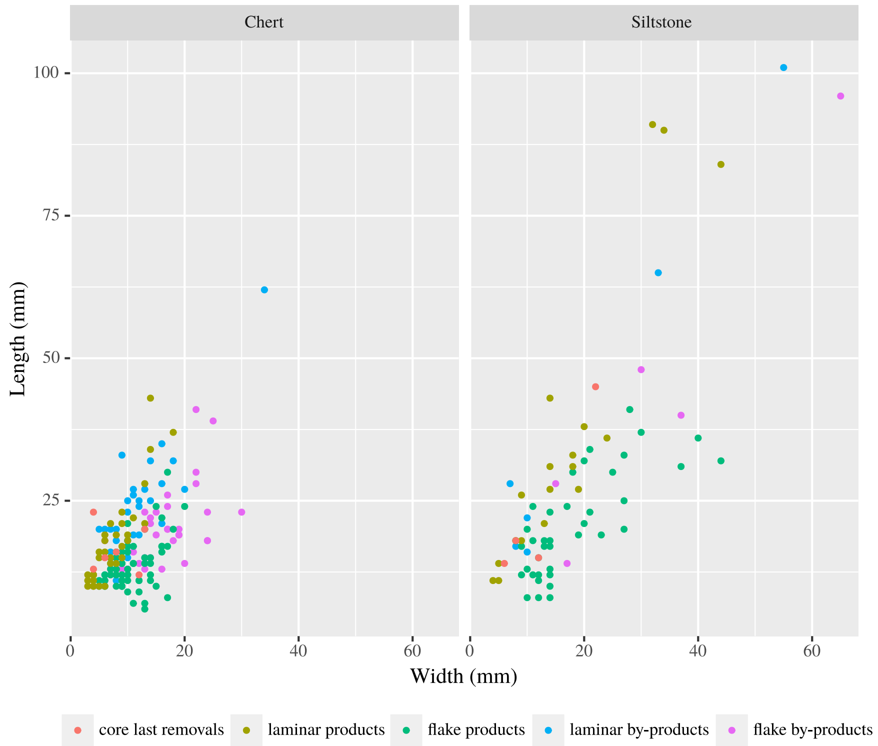

Figure 11.2: Casalecchio. Scatterplot of length and width values of products, by-products and core last removals.

11.4.3 Cores

The lithic assemblage includes 14 cores, 10 of which in chert (Figure 11.3; 11.4) and 4 in silicified siltstone (Figure 11.5). Cores reflect a generally laminar/lamellar production as suggested by the elongated scars attested on the debitage surfaces (Table 11.9). The chert series also attests the presence of mixed productions, in which both bladelets and flakes were obtained.

Most chert cores present a single debitage surface (Table 11.10) that could be exploited by 1 or 2, either opposite or orthogonal, striking platforms (Table 11.11). In two other cases cores were frequently reoriented and multiple surfaces and platforms were successively employed. The two remaining pieces are represented by a core fragment and an opened cobble, abandoned before debitage took place. One among the four silicified siltstone cores was abandoned during the first, large-sized production phase (Figure 11.5, 1). It is represented by a large and flattish blank (65 x 75 x 25 mm) attesting the exploitation of, at least, two opposite surfaces from three different striking platforms. In the other three, production is oriented to smaller bladelets. Two of them are represented by small angular blocks that were exploited from two or more striking platforms. The latter one is a large flake in which unidirectional sequences of bladelets were flaked on the dorsal face, with a *semi-tournant* rhythm (Figure 11.5, 3).

A difference in the exploitation intensity can be appreciated when comparing

Table 11.8: Casalecchio. Maintenance blanks.

	Chert		Siltstone	
Neo-crested blades	3	6.1%		
Reorientation flakes	6	12.2%	1	16.7%
Surface maintenance flakes	9	18.4%	1	16.7%
Maintenance flakes from opposite st. platform	3	6.1%		
Tablettes	1	2.0%		
Striking platform maintenance flakes	1	2.0%		
Generic maintenance flakes	26	53.1%	4	66.7%
Total	49	100%	6	100%

Table 11.9: Casalecchio. Objectives of the production attested by cores.

	Chert		Siltstone	
Bladelets	6	60.0%	2	50.0%
Laminar flakes			1	25.0%
Mix	1	10.0%		
Undetermined	3	30.0%	1	25.0%
Total	10	100%	4	100%

the two series. Half chert cores were almost exhausted at the time of their discard. Dimensions are supposed to be the main cause for their abandonment along with the presence of hinged removal scars. On the contrary siltstone cores were all discarded during an early exploitation stage and do not present major issues for the prosecution of debitage process. The only exception is represented by the laminar core that was intensively exploited.

Table 11.10: Casalecchio. Number and relative position of debitage surfaces.

	Chert		Siltstone	
One	6	6.0%	1	1.0%
Two consecutive			1	1.0%
Two opposite			1	1.0%
Three or more	2	2.0%	1	1.0%
Undetermined	2	2.0%		
Total	10	100%	4	100%

Table 11.11: Casalecchio. Number and relative position of striking platforms (ds = debitage surface).

	Chert		Siltstone	
One	4	4.0%	1	1.0%
Two opposites - same ds	1	1.0%		
Two orthogonal - same ds	1	1.0%	1	1.0%
Three			1	1.0%
More than three	2	2.0%	1	1.0%
Undetermined	2	2.0%		
Total	10	100%	4	100%

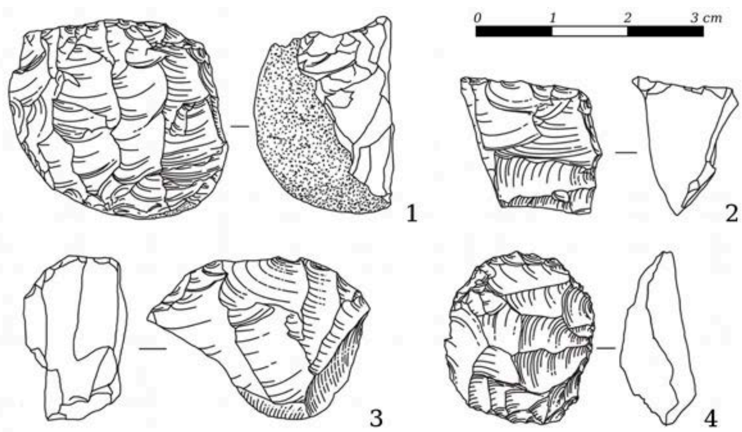

Figure 11.3: Casalecchio di Reno. Cores (drawing D. Mengoli) (after Fontana et al., 2009b).

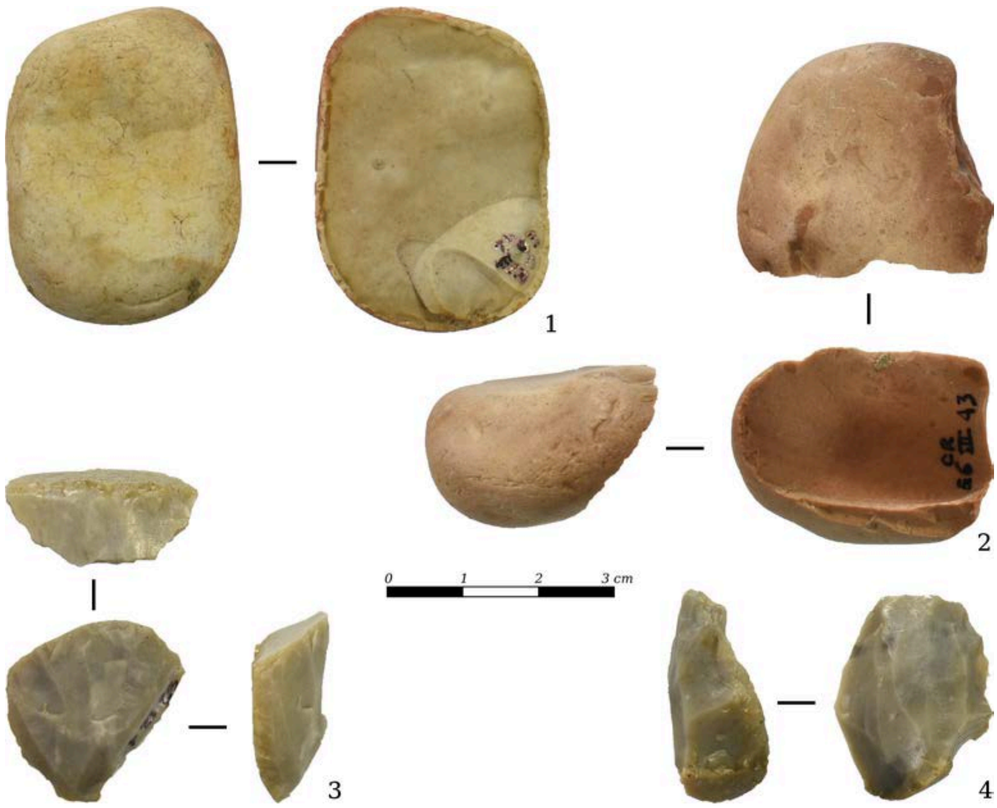

Figure 11.4: Casalecchio di Reno. Chert pre-cores and cores: 1, cobble splitted by bipolar percussion; 2, opened but unexploited cobble; 3-4, lamellar cores.

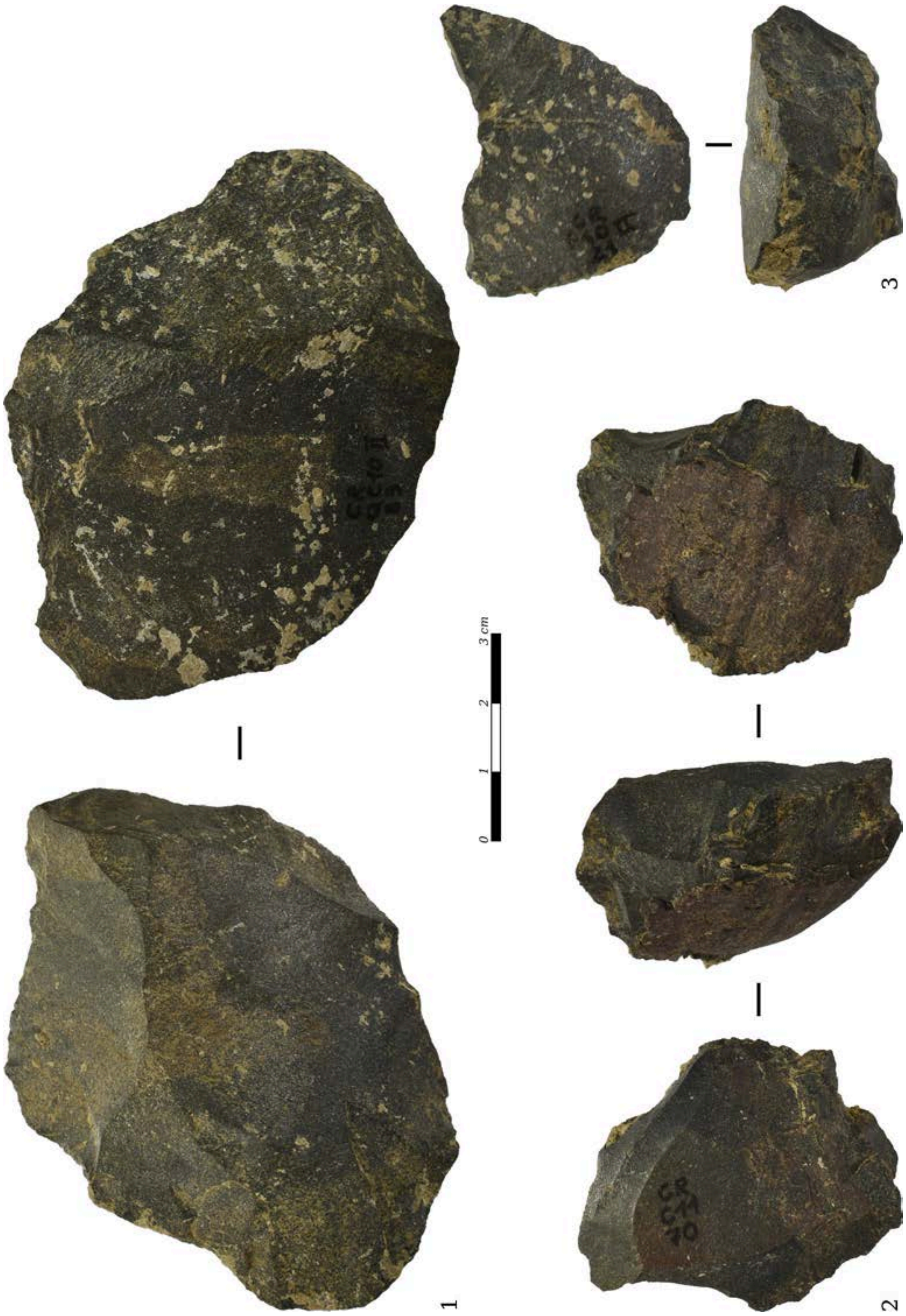

Figure 11.5: Casalecchio di Reno. Silicified siltstone cores.

11.5 Blanks selection and transformation

For the manufacture of microliths, chert blanks were preferentially selected (Table 11.12). The use of silicified siltstone ones is attested by a few backed fragments and almost none entire artefact. In most cases it was not possible to determine the exact type of blank that was selected due to the intensity of modification by retouch. Lamellar blanks seem to have been preferred (13), while the use of flakes is attested by a single artefact. There is no evidence of the utilization of by-products.

Entire microliths, although being few, attest a high variability of types (Figure 11.6). Backed points are represented by a typical elongated double-backed point and by another Sauveterre-like totally backed piece. Moreover a partially backed point is attested. Scalene triangles are the most numerous among geometric microliths although a crescent and an isosceles triangle are also attested. Triangles are quite small and not particularly elongated. Dimensional values are 6-8 mm in length, 3-4 mm in width, 1 mm in thickness (with an average length/width ratio of 2.18). The crescent is slightly longer and thicker (13 x 3 x 2 mm). A partial and marginal complementary retouch is attested on one of the scalene triangles and on the crescents. Furthermore a small backed and double truncated piece (6 x 5 x 1 mm), possibly assimilable to a triangle, is attested along with two pieces abandoned under construction. Among fragments, two double backed types possibly correspond to backed points. Generic backed fragments, anyways, are predominant, in particular as regards siltstone.

Table 11.12: Casalecchio. Microlithic armatures.

	Chert		Siltstone	
Backed points	3	9.7%		
Sauveterre	*2*	*6.5%*		
natural base	*1*	*3.2%*		
Crescents	1	3.2%		
Scalene triangles	4	12.9%		
Isoscele triangles	1	3.2%		
Backed-and-truncated bladelets	1	3.2%		
Backed fragments	19	61.3%	8	100.0%
backed fr.	*10*	*32.3%*	*7*	*87.5%*
pointed backed fr.	*7*	*22.6%*	*1*	*12.5%*
double backed fr.	*2*	*6.5%*		
Under construction	2	6.5%		
Total	31	100%	8	100%

Most retouched tools were manufactured on chert initialisation/maintenance blanks or on siltstones blades or laminar flakes (Table 11.13; Figure 11.6).

Two endscrapers (Table 11.14) were manufactured on an opening flake and on a maintenance one. Both are short types and present a convex frontal retouch. The former is, actually, a double endscraper, being retouched on both ends of the tool. The two retouches are only slightly parted, giving the tool an almost circular morphology.

A cortical backed bladelet presents a distal oblique and irregular truncation associated to a marginal distal retouch thus assuming a borer-like morphology. One siltstone blade features a marginal retouch in the mid portion of one of its edges.

Retouch is direct and marginal. Another bladelet fragments, on the other hand, presents a semi-abrupt retouch.

Pieces featuring denticulated retouches are the most represented category, both as regards chert and siltstone. Three of them correspond to large siltstone laminar flakes (79-90 mm long and 42-53 mm wide). These blanks were modified with simple, direct or inverse, retouches presenting a denticulated delineation. A single edge was modified. The other four are smaller laminar blanks (length inferior to 33 mm), in which marginal, direct, denticulated retouches were shaped out.

Table 11.13: Casalecchio. Blanks selected for the production of retouched tools.

	Chert		Siltstone	
Blades/bladelets	2	28.6%	2	40.0%
Laminar flake			3	60.0%
Flake by-products	1	14.3%		
Initialisation flakes	1	14.3%		
Maintenance blades	1	14.3%		
Maintenance flakes	2	28.6%		
Total	7	100%	5	100%

Table 11.14: Casalecchio. Retouched tools.

	Chert		Siltstone	
Endscrapers	2	28.6%		
Borers	1	14.3%		
Backed pieces			1	14.3%
Retouched fr.	1	14.3%		
Denticulates	3	42.9%	4	100.0%
Total	7	100%	5	100%

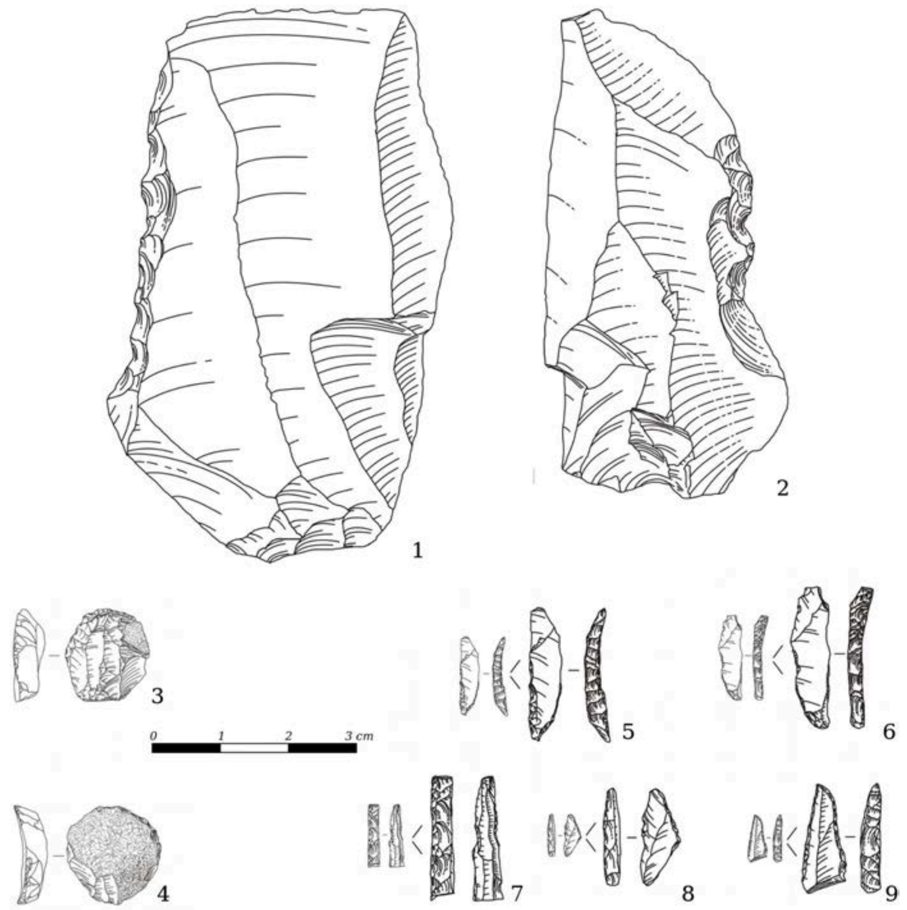

Figure 11.6: Casalecchio di Reno. Lithic industry: 1-2, denticulated flakes in siltstone; 3-4, endscrapers; 5, crescent, 6-7, backed points, 8-9, triangles (drawing D. Mengoli) (after Fontana et al., 2009b).

Chapter 12

Grottina dei Covoloni del Broion

Contents

12.1 Site introduction

On the southern slope of Mount Broion, in the Berici Hills near Lumignano (Longare, Vicenza), a calcareous cliff characterized by numerous natural cavities is located (Figure 12.1). Four of these cavities yielded prehistoric evidence: Grotta del Broion, Riparo del Broion, Buso Doppio del Broion and Grottina dei Covoloni del Broion. This latter is the only one in which the stratigraphic sequence includes Late Pleistocene and Early/Mid Holocene levels, all of the others being older.

The site was discovered by M. Da Meda in 1973. That same year the Fondazione Ligabue of Venice started an archaeological research programme in collaboration with the former Istituto di Geologia, Paleontologia e Paleontologia Umana of the University of Ferrara (Prof. A. Broglio and A. Guerreschi) and the Gruppo Grotte "G. Trevisiol" of Vicenza (Ligabue, 1973, 1974, 1975, 1977; Fedele, 2013). Researches focused at first (1973-1974) on the excavation of a trench pit at the entrance of the cave. In 1976 the investigated area was enlarged inwards, on a narrow passage leading to a small hall (3.40 x 1.70 m). The last campaign (1977) was dedicated to the study of the funerary context of the inner hall.

The stratigraphic sequence that was brought to light starts with layer 8, a gravelly rich level with light grayish silty sediments lying directly on the altered rock. Then

Figure 12.1: Panoramic view on the Mount Brosimo southern cliff, where the cave is located (photo G. Conte).

there follows a layer rich in small irregular blocks with dark brownish silty sediments (Layer 7) and one characterized by grayish silty-clayish sediments rich in small clasts and calcite concretions (Layer 6). These two latter are separated by a thin calcite level. The upper part of the sequence (Layers 5-1) is characterized by the presence of abundant clasts and eolian/colluvial sediments cemented by calcium carbonate.

Layer 8 was archaeologically sterile but for a few artefacts that, probably, originally belonged to layer 7. This yielded a Sauveterrian lithic assemblage that will be described in the following sections. The lithic assemblage of layer 6 is characterized by trapezes and notched blades obtained by pressure flaking. In accordance with the only radiocarbon dating available for the site, it was attributed to the Castelnovian and dated to 7929-7661 cal BP (2σ; R-892, 6930±60 BP). Also layer 5 is sterile while the following ones are dated to the Copper Age.

All the layers yielded macro- and micro-faunal remains, land-snails and charcoal fragments that are currently under analysis. Preliminary data concerning micromammals confirm the cultural-based chronology. In particular the assemblage from layer 8 is consistent with a cold climatic phase such as the younger Dryas (Bañuls-Cardona et al., 2015), while that from layer 4 attests mild and humid climatic conditions (Subatlantic). Palaeoenvironmental data obtained by pollen analysis (Cattani, 1977) indicate the presence of a mixed oakwood in the surroundings of the cave during the Early Mesolithic occupation.

12.2 Lithic assemblages

In this study the Early Mesolithic assemblage was analyzed (layer 7) along with the 68 artefacts and fragments, mostly smaller than 1 cm, that were identified at the top of layer 8 (included in layer 7; cf. *infra*). Totally 1786 lithic artefacts were studied (Table 12.1). Two pressure flaked bladelets were considered as out of context as they probably belong to the upper layer 6 and thus excluded from the following analysis.

Table 12.1: Grottina dei Covoloni del Broion, L. 7. Composition of the lithic assemblages.

Cortical and semi-cortical blanks	47	2.6%
Laminar blanks	76	4.3%
Flake blanks	155	8.7%
Maintenance blanks	36	2.0%
Burin spalls	7	0.4%
Undetermined fr.	914	51.2%
Flakes < 1 cm	480	26.9%
Retouched blanks	50	2.8%
Transformation wastes	17	1.0%
Cores	4	0.2%
Total	1786	100%

At a macroscopic level the assemblage is in a good preservation state, as the share of fragmented pieces is quite low: 47% (Table 12.2). Smaller fractures and edge scarring, on the other hand, are frequently attested (23.8%). The percentage of pieces altered by fire exposure is quite low: 20.9% (Table 12.3).

Table 12.2: Grottina dei Covoloni del Broion, L. 7. Integrity of the artefacts entered into the database.

Entire	137	29.1%
Incomplete	112	23.8%
Fragments	221	47.0%
Total	470	100%

Table 12.3: Grottina dei Covoloni del Broion, L. 7. Thermal alteration of the artefacts.

Unaltered	1413	79.1%
Burnt	373	20.9%
Total	1786	100%

12.3 Raw material provisioning

The Berici hills are constituted by Cenozoic neritic limestones and cherts are only sporadically attested (Bertola, 2016; Bertola et al., in press). With the exception of a restricted area located on their eastern edge where the Scaglia Rossa outcrops, the main local cherty resources are represented by the cobbles contained in the gravelly alluvial covers surrounding the hilly massif. More extensive outcrops of Scaglia Rossa are located in the Euganei hills, located a few kilometres south east of the Berici. Otherwise important lithic resources could be procured in the Lessini mountains where Mesozoic and Cenozoic cherty formations are widespread.

The analysis of cortical surfaces shows that collection strategies reflect the above presented raw material availability (Table 12.4). In particular secondary contexts such as soils and alluvial covers constitute the highest share of the assemblage. Less frequently the collection of slabs in proximity of the outcrops is also attested.

When considering exploited lithologies, Cretaceous cherts are by far the most attested ones (Table 12.5). Lower Cretaceous ones (Maiolica), in particular, are predominant followed by the Upper Cretaceous Scaglia Rossa. The analysis of textural and colour variations suggests that raw materials were collected both in the Berici-Euganei area and in the Lessini one (S. Bertola pers. com.). A more detailed analysis is needed for the quantitative assessment of the relative weight of the two groups. The use of Lessini cherts is confirmed also by the presence of one artefact realized on a Eocene calcarenite and a second one on a Jurassic Oolitic limestone that are not attested elsewhere. This latter, in particular, is a fragment of a large blade that is not consistent with the dimensions of the on-site production and was probably brought to the site as a finished tool.

Table 12.4: Grottina dei Covoloni del Broion, L. 7. Collection context of raw material.

Slope deposit	4	4.8%
Alluvial cobble	18	21.4%
Soil	31	36.9%
Undetermined	31	36.9%
Total	84	100%

Table 12.5: Grottina dei Covoloni del Broion, L. 7. Exploited lithologies.

Eocene calcarenite	1	0.2%
Scaglia Rossa	128	27.1%
Scaglia Variegata	44	9.3%
Maiolica	238	50.4%
Oolitic limestones	1	0.2%
Undetermined	60	12.7%
Total	474	100%

12.4 Reduction schemes

The lithic assemblage reflects the presence of a single reduction scheme aimed at exploiting small irregular cobbles and slabs. Presumably the size of imported raw materials was no larger than 50 mm. The flaking process was destined to the production of flakes and bladelets (Table 12.6) shorter than 40 mm.

12.4.1 Initialisation

The initialisation of debitage was based on the exploitation of the natural morphologies of collected blocks. In particular cortical bladelets were detached in correspondence of naturally convex edges (Table 12.7). The partial shaping out of cores is attested by a

Table 12.6: Grottina dei Covoloni del Broion, L. 7. Products and by-products.

Main products	**166**	**63.1%**
Blades	38	22.9%
Laminar flakes	16	9.6%
Flakes	112	67.5%
Laminar by-products	**29**	**11.0%**
Semi-cortical blades	9	31.0%
Naturally backed blades	14	48.3%
Cortical naturally backed blades	6	20.7%
Flake by-products	**68**	**25.9%**
Semi-cortical flake	25	36.8%
Naturally backed flakes	34	50.0%
Cortical naturally backed flakes	9	13.2%
Total	263	100%

single unilateral crested blade. Initialisation and, in general, cortical or semi-cortical blanks are few (Table 12.1), possibly attesting the importation of partially exploited cores on-site although a bias due to the incompleteness of the excavated surface cannot be excluded.

Table 12.7: Grottina dei Covoloni del Broion, L. 7. Initialisation blanks.

Crested blades	1	7.7%
Opening blades	3	23.1%
Naturally crested blades	4	30.8%
Generic cortical flakes	5	38.5%
Total	13	100%

12.4.2 Production

As attested by Table 12.6, products are represented by bladelets, laminar flakes and flakes, the latter being the most abundant. Bladelets are, tendentially, characterized by triangular cross-sections (51.9%) and irregularly parallel edges. By-products are much less frequent, in particular as regards lamellar productions. When analyzing metrical values production ranges are quite small (Table 12.8; Figure 12.2). Half of the bladelets are around 20 to 24 mm in length and 7 to 12 in width. Flakes and flake by-products, averagely, are even smaller. Less frequently some larger blanks were produced (up to 42 mm). This category could be importantly underrepresented as, by comparing unmodified blanks, retouched artefacts and cores, it can be surmised that these blanks were one of the main aim of the production. Most of retouched tools, in fact, are consistent with this dimensional range.

Products and by-products present preponderantly unidirectional scars on the dorsal face suggesting that debitage proceeded by unidirectional sequences of removals, occasionally interrupted by orthogonal reorientations (less than 10% of the artefacts). This is attested also by some reorientation blanks, in particular flakes (Table 12.9). The maintenance of debitage surfaces was mainly achieved by detaching some naturally backed blanks during production sequences of removals. When this integrated system was not sufficient or at the occurrence of knapping errors, large flakes could be removed from the same striking platform or, more rarely, from an opposite one, if present. More rarely neo-crests were shaped out. Striking platform maintenance flakes are well attested along with a single *tablette*.

The analysis of debitage blanks suggests that the adopted knapping technique was the direct percussion with a soft stone hammer. Butts are either flat of punctiform. The striking platform overhang was only rarely trimmed (around 22% on bladelets, even less on other categories). One of the cores also attests the use of bipolar percussion. Although it is difficult to estimate the role and incidence of this technique in the production of the lithic assemblage, the fact that only 3 of the flaked blanks showed traces of this technique suggests that its application was only secondary and not systematic.

Table 12.8: Grottina dei Covoloni del Broion, L. 7. Summary of the metric values of debitage products and by-products (A = blades, B = laminar by-products, C = flakes, D = flake by-products).

		A	B	C	D
Lenght	Min.	12	16	8	8
	1st Qu.	19.75	17.75	13	13.75
	Median	21	23	15	15.5
	Mean	21.9	22.33	15.75	17.25
	3rd Qu.	24	26.75	17	20.25
	Max.	42	28	40	30
	σ	6.49	5.32	5.21	5.43
	Count	20	6	71	40
Width	Min.	3	4	7	6
	1st Qu.	7.25	8	11	11
	Median	9	10	13	14
	Mean	9.52	10.48	14.57	15
	3rd Qu.	11.75	13	17	18
	Max.	23	16	35	30
	σ	3.5	3.41	5.33	4.83
	Count	54	27	101	65
Thickness	Min.	1	1	1	1
	1st Qu.	2	2	2	2
	Median	2	3	2	3
	Mean	2.41	3.62	2.67	3.72
	3rd Qu.	3	4	3	4
	Max.	9	8	8	10
	σ	1.28	1.95	1.4	2.01
	Count	54	29	111	67

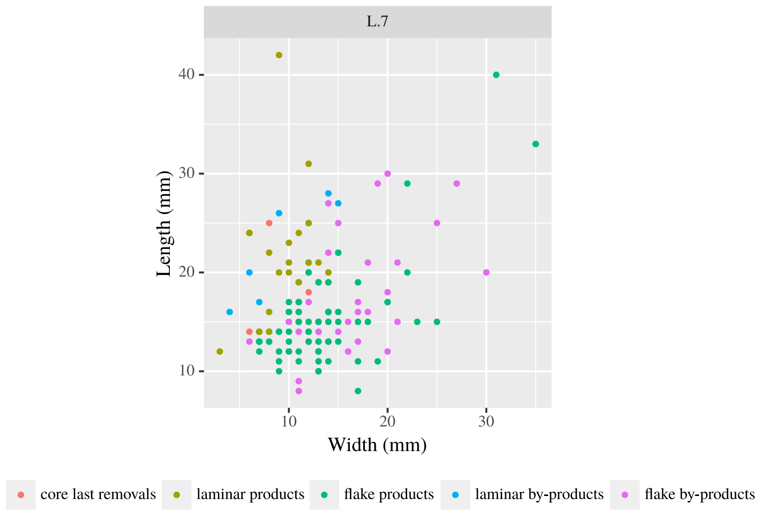

Figure 12.2: Grottina dei Covoloni del Broion, L. 7. Scatterplot of length and width values of products, by-products and core last removals.

Table 12.9: Grottina dei Covoloni del Broion, L. 7. Maintenance blanks.

Partially neo-crested blades	1	2.8%
Proximal reorientation blades	1	2.8%
Reorientation flakes	5	13.9%
Surface maintenance blades	2	5.6%
Surface maintenance flakes	4	11.1%
Maintenance flakes from opposite st. platform	2	5.6%
Tablettes	1	2.8%
Striking platform maintenance flakes	6	16.7%
Generic maintenance flakes	14	38.9%
Total	36	100%

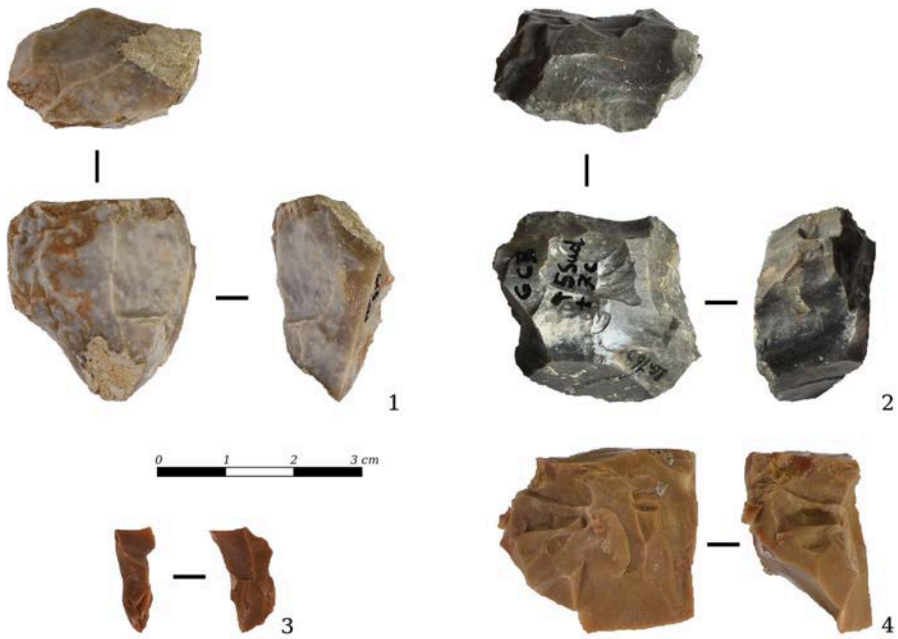

Figure 12.3: Grottina dei Covoloni del Broion, L. 7. Cores. Number 3 was flaked with bipolar percussion technique.

12.4.3 Cores

The lithic assemblage included only 4 cores, one of which is the bipolar percussion one (Figure 12.3). This could not be analyzed as the others, considering that such a technique does not provide a level of predetermination comparable to that of direct percussion. Moreover another one is fragmentary and did not allow a complete analysis to be carried out.

The remaining two cores were aimed respectively at the production of bladelets and flakes (Table 12.10). The former attests the presence of a single debitage surface exploited by a single striking platform with a semi-tournant modality (Tables 12.11 and 12.12). On the latter, multiple surfaces and platforms are attested and exploitation modality was mostly frontal. The overhang was trimmed only in the lamellar one. Both were abandoned during the debitage process, following a hinged detachment.

The bipolar core attests a unique exploitation modality, without visible reorientations. It was abandoned after being overexploited. Dimensions of the core are 15 x 7 x 5 mm.

Table 12.10: Grottina dei Covoloni del Broion, L. 7. Objectives of the production attested by cores.

Bladelets	1	25.0%
Flakes	1	25.0%
Undetermined	2	50.0%
Total	4	100%

Table 12.11: Grottina dei Covoloni del Broion, L. 7. Number and relative position of striking platforms (ds = debitage surface).

One	3	75.0%
More than three	1	25.0%
Total	4	100%

Table 12.12: Grottina dei Covoloni del Broion, L. 7. Number and relative position of debitage surfaces.

One	3	75.0%
Three or more	1	25.0%
Total	4	100%

12.5 Blanks selection and transformation

12.5.1 Microlithic armatures

Table 12.13: Grottina dei Covoloni del Broion, L. 7. Blanks selected for the production of microlithic armatures.

Bladelet	6	50.0%
Bladelet/flake	3	25.0%
Flake	1	8.3%
Cortical flake	1	8.3%
Undetermined	1	8.3%
Total	12	100%

Most blanks selected for the production of microliths are represented by bladelets (Table 12.13). Along with them, also flakes and cortical flakes are attested. The number of microliths is reduced to 12 elements, 7 of which are constituted by fragments (Table 12.14; Figure 12.4). Among entire pieces, a small Sauveterre-like backed point is attested. It measures 13 x 4 x 1 mm and was manufactured with a straight lateral total retouch. Two crescents featuring a slightly angular backed side and complementary retouches are also attested. They measure respectively 9 and 10 mm in length, 3 mm in width and 1 mm in thickness. The larger of the two presents a *piquant-trèdre*. Additionally one backed bladelet and one backed-and-truncated bladelet are also included. Both were manufactured on lamellar blanks. In the latter one the truncation was not shaped by retouch but created with the microburin technique. The adoption of this technique is attested also by four microburins. One of them is proximal and the notch was performed on the right side while the other 3 are distal and left-sided. The other transformation wastes attested are 13 retouch-flakes.

12.5.2 Retouched tools

Retouched tools were mainly manufactured out of laminar and flake by-products along with some flakes and laminar flakes (Table 12.15). From a typological point of

Table 12.14: Grottina dei Covoloni del Broion, L. 7. Microlithic armatures.

Backed points	1	8.3%
Sauveterre	*1*	*8.3%*
Crescents	2	16.7%
Backed bladelets	1	8.3%
Backed-and-truncated bladelets	1	8.3%
Backed fragments	5	41.7%
backed fr.	*4*	*33.3%*
double backed fr.	*1*	*8.3%*
Retouched fragments	2	16.7%
Total	12	100%

Figure 12.4: Grottina dei Covoloni del Broion, L. 7. Retouched artefacts: 1, truncation with residues of a red colouring material; 2, truncation presenting a localized white patina; 3, splintered piece; 4, backed point; 5-6, crescents; 7-8, backed bladelets; 9, backed-and-truncated bladelet; 10-11, burins.

Table 12.15: Grottina dei Covoloni del Broion, L. 7. Blanks selected for the production of retouched tools.

Blades/bladelets	1	2.6%
Laminar flake	3	7.9%
Blades/flakes	7	18.4%
Flakes	5	13.2%
Naturally backed bladelets	4	10.5%
Naturally backed flakes	4	10.5%
Semi-cortical flakes	5	13.2%
Maintenance flakes	1	2.6%
Undetermined	8	21.1%
Total	38	100%

view the assemblage is dominated by endscrapers (Table 12.16; Figure 12.5). Most of the other types are attested only by single elements or so (Figure 12.4).

All the entire endscrapers are short types with a single exception. This is represented by a thick, plunging naturally backed bladelet in which the natural morphology of the distal end was only slightly modified with a marginal retouch. Fourteen of the short ones present a wide retouched front and 8 of them also lateral retouches in at least one of the two sides. Furthermore one circular, one nosed and two double endscrapers are attested. One of these latter associate a wide frontal type to a nosed one, while the other two are nosed types. The remaining 6 endscrapers are represented by undeterminable fragments. As regards dimensional values, with the exception of the long type (41 mm), length values span between 14 and 23 mm with an average value of 18 mm. Width is comprised between 12 and 24 mm and thickness between 2 and 9 with average values of respectively 18 and 6 mm.

Of the three burins, one is a straight dihedral type probably manufactured on a burin spall; the others feature a single burin spall detached respectively from a fracture and an oblique truncation. Blanks selected for these latter are a semi-cortical flake and a naturally backed one.

The three truncations were realized on laminar blanks and in particular a laminar flake, a bladelet and a naturally backed bladelet. One of them presents a marginal retouch while the two other have invasive ones. Truncations are right angled with respect to debitage axis.

On a semi-cortical flake a convex backed retouch forms a sort of short backed knife (26 x 15 x 4 mm). Among remaining pieces a fragment with an undeterminable backed retouch and two pieces with semi-abrupt retouches are present. One of the two presents bilateral inverse semi-abrupt retouches while the other is fragmentary. Another semi-cortical flake presents a denticulated backed side. Finally two composite tools are attested. One is a most peculiar piece with two opposite truncations and a notched lateral side. Considering its small dimensions (inferior to 15 mm) it is difficult to be interpreted. The second one is a splintered piece in which one of the two sides presents a partial semi-abrupt retouch. This possibly was meant to strengthen and regularize the tool.

Table 12.16: Grottina dei Covoloni del Broion, L. 7. Retouched tools.

Burins	3	7.9%
Endscrapers	25	65.8%
Truncations	3	7.9%
Backed knives	1	2.6%
Backed fr.	1	2.6%
Retouched pieces	1	2.6%
Retouched fr.	1	2.6%
Denticulates	1	2.6%
Composite mixed tools	2	5.3%
Total	38	100%

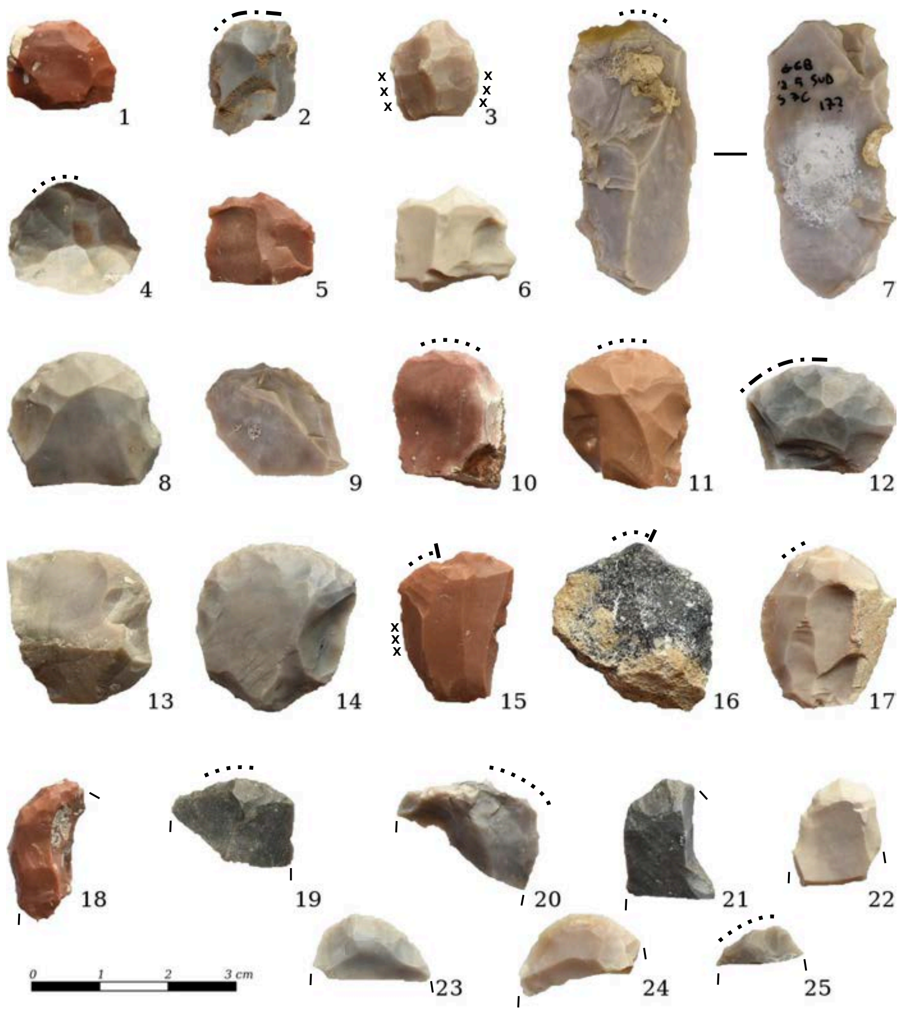

Figure 12.5: Grottina dei Covoloni del Broion, L. 7. Endscrapers. The dotted line indicates edge rounding; dash-and-dotted line indicates the presence of bending removals; "X" indicates hafting traces.

12.6 Use and wear

Functional analysis involved all of retouched artefacts and debitage blanks larger than 1 cm. At a general level the preservation state of the assemblage is not excellent. Surface alterations mostly of chemical (cf. soil sheen) and mechanical origin (abraded surfaces) are widespread. Taphonomic microchipping, on the other hand, is not as intense as the former and mostly localised, rarely affecting all the edges. These alterations probably erased all eventual micro-polishes. Therefore, the identification of use-wear traces mostly relied on the analysis of edge rounding and micro-scarring.

As regards microlithic armatures a single backed fragment yielded a diagnostic impact fracture consisting of a composite bending fracture with a spin-off located in the distal (apical?) end of the artefact.

Similarly a single unmodified flake yielded use-wear traces. In this perspective the generally small dimensions of debitage should be considered. Most blanks are too small to be directly used and their functional potential is limited. On the right side of the flake small, alternating, oblique semicircular or trapezoidal, feather terminating removals attest a longitudinal action on a soft material.

Among retouched tools 12 endscrapers yielded use-wear traces (Figure 12.5). These are represented by a marginal, asymmetric rounding developed towards the dorsal aspect of the blank (retouched front)(cf. Figure 12.6). In most of them rounding is not homogeneous and does not affect the entire front being particularly developed laterally. Moreover two endscrapers present some fine bending removals in correspondence of the front that could be related to the tool use. At a general level the evidence is consistent with the scraping of a soft and resistant material, such as hide, although the absence of polishes does not allow to fully confirm this. The low degree of rounding is comparable to that obtained with experimental artefacts and can be related to the hardness of the lithic raw material. Additionally 2 endscrapers yielded hafting traces represented by short and wide, trapezoidal or rectangular, hinge-terminating bending removals on one or both lateral edges. On-site resharpening of endscrapers is attested by, at least, 2 pieces in which the edge rounding was partially removed by successive retouches. The systematic application of this procedure could also partially explain the high percentage of flakes smaller than 1 cm with respect to the entire lithic assemblage (Table 12.1). It seems that endscrapers were abandoned only after their overexploitation or following major fractures. With the exception of the partially retouched long endscraper (cf. *infra*), the only pieces that yielded use-wear traces and are longer than 2 cm are the two abandoned during resharpening and two others featuring major proximal fractures. The other 6 present length values comprised between 14 and 18 mm. Three endscrapers also attest the presence of irregular and patchy red ochre residues. These, anyways, are distributed both in the ventral and dorsal face of the blanks and cannot be directly related to any functional edge.

Ochre residues are associated to the transversal retouched edge of a thick truncated bladelet. Residues, in particular, are located in correspondence of the ridges formed by retouch removal that appears particularly rounded. Unfortunately this piece was heavily affected by post-depositional damages. In particular a large abrasion zone in correspondence of the ventral face does not allow to appreciate the distribution of use-wear along the presumed contact surface. Nonetheless the disposition of the rounding and the distribution of ochre residues suggest a transversal motion with a high working angle.

A truncated blade manufactured in a Maiolica lithotype outcropping in the Lessini area and not attested at the site by other elements, presents a well developed rounding in correspondence of all of its edges and ridges but for the ones formed by the proximal fracture. Additionally invasive, bifacial and irregular removals are present on both edges. Such features seem to confirm that this tool was manufactured elsewhere, being consistent with accidental travel-induced damage. Both the raw material subtype and its presumed original dimensions allow excluding that it was flaked on-site.

Figure 12.6: Grottina dei Covoloni del Broion, L. 7. Use-wear traces attested on endscrapers: A-C, edge rounding; D-F, small step-terminating bending removals; G, rounded edge partially resharpened by retouch; H, hafting traces (all photos taken at 10X).

Chapter 13

Cima XII

Contents

13.1 Site introduction

The Sette Comuni plateau is one of the main Venetian pre-Alpine massifs, located at the borderline between the Vicenza and Trento provinces, and surrounded by the rivers Astico and Brenta. The central plain area is enclosed by high mountain ridges reaching 2341 m a.s.l. The limestones that constitute the plateau have been intensively modelled by karstic and glacial phenomena resulting in the widespread presence of typical geomorphological features such as sinkholes and karren-fields. Surface hydrography is almost completely absent.

In 1957 and 1985 A. Allegranzi identified two lithic scatters on the southern slope of Cima XII (Figure 13.1), one of the main peaks of the northern ridge (Frigo and Martello, 1994). In 1992 a survey conducted by G. Frigo and G. Martello (1994) allowed re-identifying one of the two above mentioned lithic scatters (named CD1) along with 3 more sites (CD2-4). Between 1993 and 1996 the University of Ferrara (D.E. Angelucci, A. Broglio, M. De Stefani and M. Peresani) continued the researches and 23 other sites were discovered (Broglio et al., 2006). Totally 27 sites, situated between 2000 and 2080 m a.s.l., were identified and 13.362 lithic artefacts were collected. Four of these sites were systematically investigated (CD2, CD3, CD4 and CD9) but only 2 yielded a high number of artefacts: CD3 and CD9.

In this area of the plateau soils are particularly thin and discontinuous because of erosive phenomena of anthropic origin (in particular pastoralism and war activities during the past century). This led, in most of the sites, to the simple collection of the

Figure 13.1: The southern slope of Cima XII.

lithic artefacts coming to light, according to a reference grid. Only in karst hollows, the soil cover was preserved and an actual excavation took place. Here rendzina and podzols profiles were identified. Artefacts were dispersed in the entire sedimentary sequence by post-depositional processes although their distribution suggests that the stratigraphic position of the Mesolithic settlement was between the horizons E and B. Faunal remains were not preserved and charcoal fragments were extremely rare and poorly preserved. No radiocarbon dating is available.

On the base of a typological comparison with the Adige sequence, A. Broglio proposed that site CD3 was to be attributed to a mid phase of the Sauveterrian while CD9 to a later phase.

13.2 Lithic assemblages

The lithic assemblages belonging to sites CD3 and CD9 were analysed. These had already been the object of a previous techno-typological analysis (Broglio et al., 2006). In particular all the artefacts that were collected during the systematic excavations of the University were re-studied. Artefacts collected during surveys and lacking a spatial attribution (in particular CD3) were excluded. The two analysed assemblages are respectively composed of 6519 and 4973 artefacts (Table 13.1).

Although the percentage of fragments is relatively low (Table 13.2), depositional conditions importantly affected the preservation state of the assemblage. Edge damages and scarring are widespread as reflected also by the high share on incomplete artefacts. Moreover 16-19.6% respectively of the artefacts entered into the database presented thick patinas. At CD3, moreover, 56.9% of the assemblage was thermally altered (Table 12.3). This percentage is much lower on site CD9. The poor preservation state of the assemblage, as regards both edges and surfaces did not allowed for a functional analysis to be carried out.

Table 13.1: Cima XII, sites CD3, CD9. Composition of the lithic assemblages.

	CD3		CD9	
Cortical and semi-cortical blanks	138	2.1%	152	3.1%
Laminar blanks	352	5.4%	324	6.5%
Flake blanks	304	4.7%	296	6.0%
Maintenance blanks	99	1.5%	96	1.9%
Burin spalls	36	0.6%	31	0.6%
Undetermined fr.	4105	63.0%	2603	52.3%
Flakes < 1 cm	995	15.3%	1179	23.7%
Retouched blanks	143	2.2%	115	2.3%
Transformation wastes	329	5.0%	143	2.9%
Cores	18	0.3%	34	0.7%
Total	6519	100%	4973	100%

Table 13.2: Cima XII, sites CD3, CD9. Integrity of the artefacts entered into the database.

	CD3		CD9	
Entire	481	33.9%	461	39.6%
Incomplete	265	18.7%	242	20.8%
Fragments	671	47.4%	461	39.6%
Total	1417	100%	1164	100%

13.3 Raw material provisioning

Lithic raw material procurement system can be considered local as all of the exploited lithologies could be procured in the Sette Comuni plateau, in a radius of around 15 kilometres from the sites. The highest majority of them were collected in secondary deposits, not far from the outcrops, as attested by the rounding intensity of cortical surfaces, mostly characterized by subangular to subrounded edges (Table 13.4). Furthermore, most cortical surfaces present a marked surface corrosion consistent with highland exposed deposits. A few blanks (particularly attested at CD3) are characterized by oxide depositions suggesting their collection in karstic residual soils.

As regards lithologies, all the 3 chert-bearing formations of the plateau were exploited, although with different percentages: the Jurassic limestones of the Rosso Ammonitico and the Cretaceous ones of the Maiolica and Scaglia Rossa (Table 13.5). Maiolica is by far the most exploited group, and also the most widespread raw material.

Table 13.3: Cima XII, sites CD3, CD9. Thermal alteration of the artefacts.

	CD3		CD9	
Unaltered	2809	43.1%	3067	61.7%
Altered	3710	56.9%	1906	38.3%
Total	6519	100%	4973	100%

It is followed by Scaglia Rossa that outcrops only in delimited areas of the mid sector of the plateau. Most likely the Rosso Ammonitico cherts were collected in the same spots as the Maiolica. In fact these two formations are in stratigraphic continuity. Furthermore, a high number of archaeological artefacts present intermediate features (i.e. colour, texture) suggesting they belong to the transitional levels between the two formations. For the lithological attribution the majority of the artefacts were observed with a stereomicroscope under polarized incident light. This was necessary due to the presence of patinas that frequently did not allow to distinguish the Rosso Ammonitico reddish-purple colour from the Scaglia Rossa one. The distinction between Rosso Ammonitico and Maiolica was mostly based on colour and on the size of radiolarites (larger and inhomogeneous in Jurassic samples).

Table 13.4: Cima XII, sites CD3, CD9. Collection context of raw material.

	CD3		CD9	
Outcrops or in proximity			1	0.5%
Slope deposits	100	54.9%	141	64.4%
Soils	16	8.8%	1	0.5%
Undetermined	66	36.3%	76	34.7%
Total	182	100%	219	100%

Table 13.5: Cima XII, sites CD3, CD9. Exploited lithologies.

	CD3		CD9	
Scaglia Rossa	183	12.9%	93	8.0%
Maiolica	811	57.2%	886	76.1%
Rosso Ammonitico	162	11.4%	65	5.6%
Undetermined	261	18.4%	120	10.3%
Total	1417	100%	1164	100%

13.4 Reduction schemes

Lithic raw material exploitation on both sites was aimed at obtaining two main set of products. The former, attested only by a low number of artefacts, corresponds to large laminar products and by-products (longer than 40-45 mm). The latter, representing the most important objective from a numerical point of view, is represented by smaller bladelets, laminar flakes and flakes (Table 13.6). Such objectives were reached through two reduction schemes. The former was aimed at the exploitation of large cherty slabs (70-90 mm). On the threshold of 40-45 mm some cores were abandoned while other continued to be exploited for obtaining lamellar and flake products. Such a production was also the aim of the second reduction scheme that, on the other hand, started with small cobbles/slabs and large flakes.

Table 13.6: Cima XII, sites CD3, CD9. Products and by-products.

	CD3		CD9	
Main products	**540**	**69.9%**	**464**	**62.6%**
Blades	219	40.6%	159	34.3%
Laminar flakes	63	11.7%	85	18.3%
Flakes	258	47.8%	220	47.4%
Laminar by-products	**121**	**15.7%**	**119**	**16.1%**
Semi-cortical blades	50	41.3%	36	30.3%
On the edge blades	1	0.8%	1	0.8%
Semi-cortical on the edge blades	1	0.8%	3	2.5%
Naturally backed blades	56	46.3%	69	58.0%
Cortical naturally backed blades	13	10.7%	10	8.4%
Flake by-products	**112**	**14.5%**	**158**	**21.3%**
Semi-cortical flake	66	58.9%	82	51.9%
Naturally backed flakes	35	31.3%	54	34.2%
Cortical naturally backed flakes	11	9.8%	22	13.9%
Total	773	100%	741	100%

13.4.1 Initialisation

Initialisation blanks are not frequent and mostly represented by generic cortical flakes (Table 13.7). The predominance of opening flakes and blades/bladelets, in particular extracted along natural ridges suggests that the initialisation of debitage was mostly direct and based on the exploitation of natural morphologies. Only 2 crested blades (one of which unilateral) attest a partial shaping of the cores prior to their flaking. Considering the ephemeral presence of artefacts attributable to the first phase of the first reduction scheme, it is difficult to reliably assess whether any difference exists between the initialisation modalities of the two schemes, although it can be presumed that they were similar.

Table 13.7: Cima XII, sites CD3, CD9. Initialisation blanks.

	CD3		CD9	
Crested blades	1	4.8%	1	3.2%
Opening blades	2	9.5%	1	3.2%
Naturally crested blades	4	19.0%	8	25.8%
Opening flakes	1	4.8%	4	12.9%
Generic cortical flakes	13	61.9%	17	54.8%
Total	21	100%	31	100%

13.4.2 Production

As regards the first reduction sequence, the narrow and long faces of slabs and cobble fragments were flaked for the production of a few laminar blanks, among which proper blades but also naturally backed ones. Maximum dimensional values reach 62 mm in length for site CD3 and 67 for site CD9 (Table 13.8 and Figure 13.2). At both sites some large semi-cortical flakes are also attested. Successively cores were reduced either through exploitation and maintenance (detachment of striking platform maintenance flakes) cycles or through orthogonal reorientation (Figure 13.3).

Once crossed the 40-45 mm threshold, the flaking process became more systematic and the productivity increased, although some of the cores had already been abandoned. To this production phase can be assimilated also that concerning the smaller cobbles and large flakes belonging to the second reduction scheme. Half of the blades/bladelets production attests length values of respectively 19-35.3 mm at CD3 and 17-29 mm at CD9 (Table 13.8). Although maximum values are comparable, production in the former site was in average a few millimeters longer. Bladelets generally present triangular cross-sections (61.7 - 41%) and irregular parallel edges. The negatives on the dorsal face indicate a predominance of unidirectional flaking sequences. The same is attested also for flakes and by-products. Both lamellar and flake by-products, in particular belonging to site CD3, attest the presence of bidirectional removals (inferior to 10%). Considering that these are almost absent in flakes and limited in bladelets, it can be argued that they are more likely be referred to the reorientation of the cores than to an actual bidirectional exploitation.

Table 13.8: Cima XII, sites CD3, CD9. Summary of the metric values of debitage products and by-products (A = blades, B = laminar by-products, C = flakes, D = flake by-products).

		CD3				CD9			
		A	B	C	D	A	B	C	D
Length	Min.	13	13	9	6	10	12	8	10
	1st Qu.	19	22	13	15.25	17	21	12	16.5
	Median	24	27	16	22.5	22	27	14	21
	Mean	27.04	30.25	17.66	25.12	24.12	28.98	15.74	22.85
	3rd Qu.	35.25	37.75	20.25	30	29	33.5	17	27.5
	Max.	62	54	40	73	67	65	45	62
	σ	10.73	12.12	6.18	12.95	10.08	11.91	5.51	8.81
	Count	76	24	152	66	89	51	159	123
Width	Min.	3	4	6	7	3	3	6	7
	1st Qu.	7	8	10	14.75	7	8	11	14
	Median	9	10	13	18.5	10	11	14	19
	Mean	9.67	10.64	14.24	19.77	10.48	11.52	14.86	19.99
	3rd Qu.	12	12	16.5	24	13	14	17	25
	Max.	25	27	42	53	35	31	39	42
	σ	3.88	3.72	5.47	8.05	4.8	5.28	5.54	7.85
	Count	278	287	231	104	244	118	210	157
Thikness	Min.	1	1	1	1	1	1	1	1
	1st Qu.	1	2	2	3	1	2	2	3
	Median	2	2	2	4	2	3	2	4
	Mean	2.14	2.74	2.45	5.09	2.35	3.65	2.51	4.83
	3rd Qu.	3	3	3	6	3	5	3	6.75
	Max.	7	10	8	24	22	12	11	19
	σ	1.15	1.44	1.46	3.44	1.93	2.03	1.61	2.97
	Count	280	287	245	106	244	119	219	158

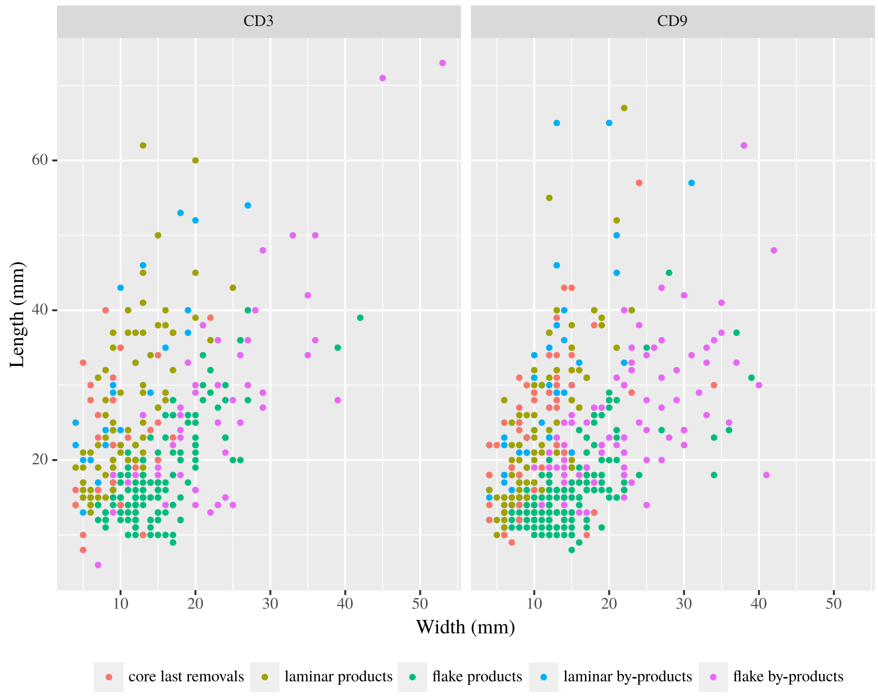

Figure 13.2: Cima XII, sites CD3, CD9. Scatterplot of length and width values of products, by-products and core last removals (hinged ones excluded).

Maintenance blanks attest that similar procedures were put in action at both sites. Surface maintenance was mostly integrated into the debitage process and irregularities were corrected by detaching thicker and more invasive laminar or flake blanks from the same striking platform, sometimes exploiting the lateral edges of the cores (Table 13.9). The shaping of neo-crests or partial neo-crests is also attested in particular at CD3. A difference in the modality cores were reoriented at the two sites can be appreciated. At CD3 cores were orthogonally re-oriented exploiting the ridges formed by the overhang or by the distal side of the previous debitage surface. At CD9, on the other hand, these blank types are almost absent and replaced by reorientation flakes and blades testifying the alternating exploitation of debitage surfaces and striking platforms (their role was inverted). At both sites also striking platform maintenance flakes and actual *tablettes* are well attested. These seem to be attested in both stages of the first reduction scheme as well as in the second.

As regards knapping techniques the morphology of products and by-products is consistent with a direct percussion with a soft stone hammer. The overhang of the striking platform was well trimmed in around half of the laminar products (respectively 56.4% and 51.2%). This percentage decreases drastically when considering the other classes of blanks, in particular as regards site CD9. Butts are generally flat. A relatively high presence of linear and punctiform types (18% of the blades of both sites) suggests that the percussion frequently aimed at striking near the overhang, with a tangential motion allowing to obtain thinner and more regular blanks.

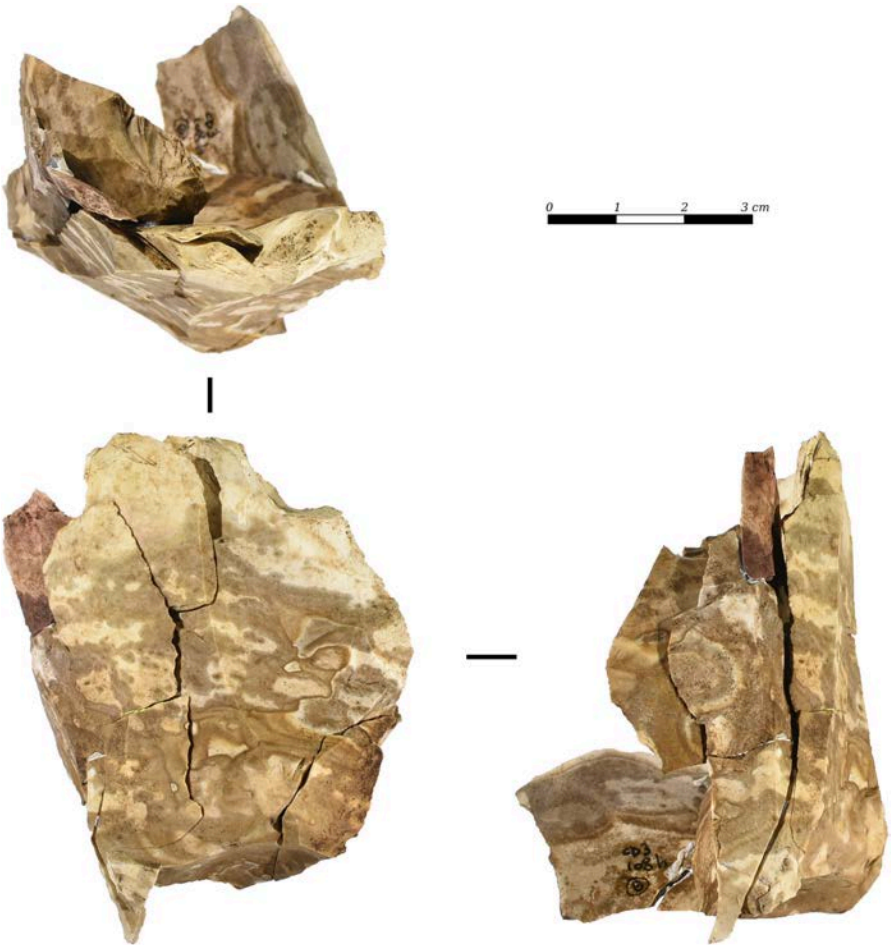

Figure 13.3: Cima XII, site CD3. Refitting assemblage showing a long sequence of unidirectional removals followed by a orthogonal reorientation.

Table 13.9: Cima XII, sites CD3, CD9. Maintenance blanks.

	CD3		CD9	
Neo-crested blades	1	1.0%	1	1.0%
Partially neo-crested blades	6	6.1%	1	1.0%
Proximal reorientation blades	7	7.1%	1	1.0%
Distal reorientation blades	2	2.0%		
Different reorientation blades	1	1.0%	4	4.2%
Reorientation flakes	3	3.0%	11	11.5%
Surface maintenance blades	3	3.0%	5	5.2%
Naturally backed surface maintenance blades	2	2.0%		
Surface maintenance flakes	17	17.2%	16	16.7%
Naturally backed surface maintenance flakes	5	5.1%	5	5.2%
Maintenance flakes from opposite st. platform	2	2.0%	1	1.0%
Tablettes	3	3.0%	3	3.1%
Striking platform maintenance flakes	17	17.2%	23	24.0%
Generic maintenance flakes	30	30.3%	25	26.0%
Total	99	100%	96	100%

13.4.3 Cores

The lithic assemblages of sites CD3 and CD9 yielded respectively 18 and 32 cores (Figure 13.4; 13.5; 13.6). One of them was abandoned during the first exploitation stage of the first reduction sequence and attests an exclusively laminar production (Table 13.10). Cores destined to a lamellar production are predominant, while flake and mixed productions are testified only by a small number of them. 6 cores of CD3 and 7 of CD9 were realized on large flakes.

Table 13.10: Cima XII, sites CD3, CD9. Objectives of the production attested by cores.

	CD3		CD9	
Blades			1	2.9%
Bladelets	13	72.2%	21	61.8%
Laminar flakes	1	5.6%	2	5.9%
Flakes	1	5.6%	2	5.9%
Mix	1	5.6%	3	8.8%
Undetermined	2	11.1%	5	14.7%
Total	18	100%	34	100%

A good share of cores features a single striking platform and debitage surface (Table 13.11 and 13.12). Two opposite striking platforms exploiting the same surface are more frequent at CD9 than at CD3. In this latter, opposite platforms generally exploit different surfaces that could either be adjacent or opposite. In both sites a few cores attest to recurrent reorientations with multiple successive exploitation phases. On edge exploitation strategies are the most attested modality (around 30% of last debitage surfaces), followed by frontal ones (mostly wide). Semi-tournant modalities are also well attested (22.2-20.6%). Flakes used as blanks for cores, were mostly exploited as burin-like cores (10), some of which on two opposite edges/surfaces. The 3 remaining flake-cores were either exploited with a facial modality (1) or as endscraper-like cores (2).

Most cores were abandoned during the flaking process (44.4-50%), and some even at its beginning (22.2-32.4%). One element from CD3 was brought to the site but neither exploited nor tested. Intensively exploited cores are attested in particular at CD3 (27.8-11.8%). Half of the cores from CD3 were abandoned after the occurrence of a hinged removal. In CD9 assemblage, on the other hand, 38.2% of them do not show any causes motivating their discard. At a general level it can be surmised that the availability of chert in proximity of the sites led to the under-exploitation and early abandonment of cores.

Table 13.11: Cima XII, sites CD3, CD9. Number and relative position of striking platforms (ds = debitage surface).

	CD3		CD9	
One	6	33.3%	14	41.2%
One +1 secondary	2	11.1%		
Two opposites - same ds	1	5.6%	7	20.6%
Two opposites - diff. ds	4	22.2%		
Two orthogonal - diff. ds	2	11.1%	6	17.6%
Three			1	2.9%
More than three	2	11.1%	3	8.8%
Undetermined	1	5.6%	3	8.8%
Total	18	100%	34	100%

Table 13.12: Cima XII, sites CD3, CD9. Number and relative position of debitage surfaces.

	CD3		CD9	
One	7	38.9%	18	52.9%
Two consecutive	5	27.8%	7	20.6%
Two opposite	3	16.7%	4	11.8%
Three or more	1	5.6%	2	5.9%
Undetermined	2	11.1%	3	8.8%
Total	18	100%	34	100%

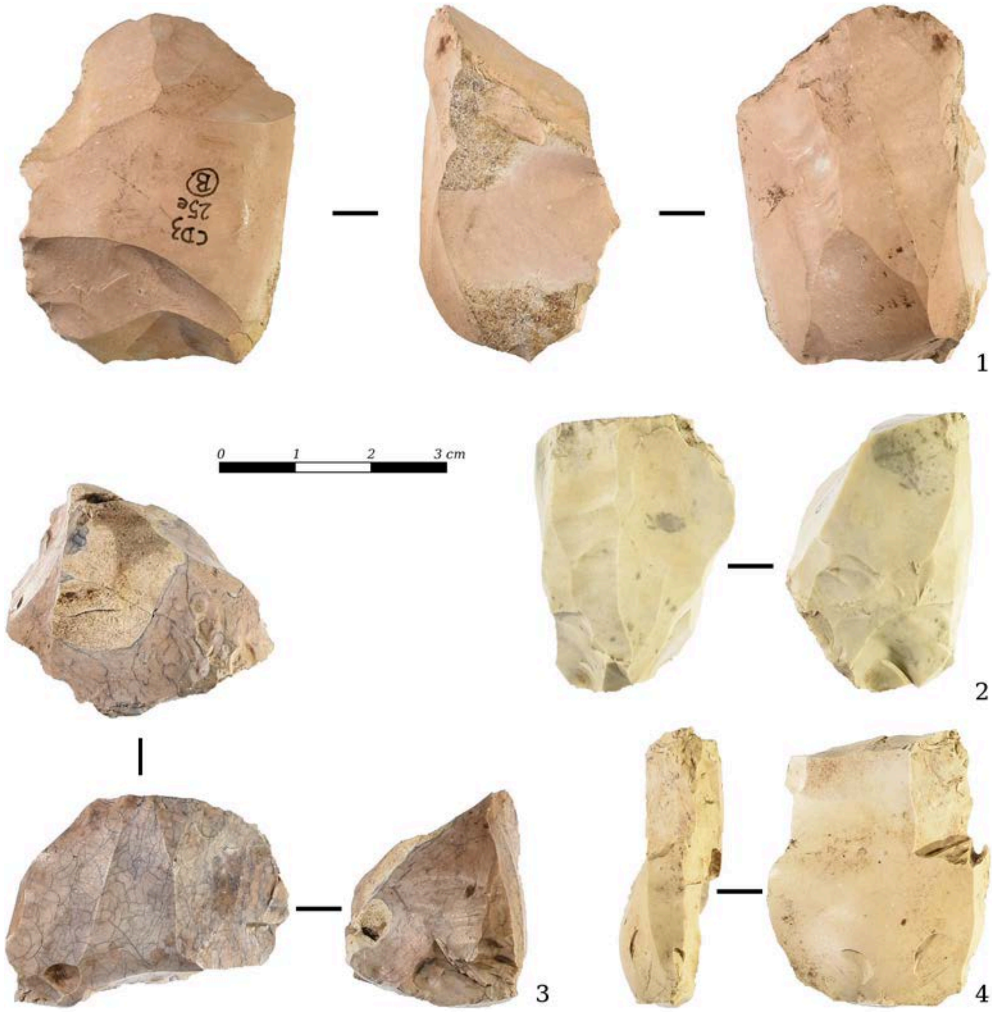

Figure 13.4: Cima XII, site CD3. Cores.

Figure 13.5: Cima XII, site CD9. Cores.

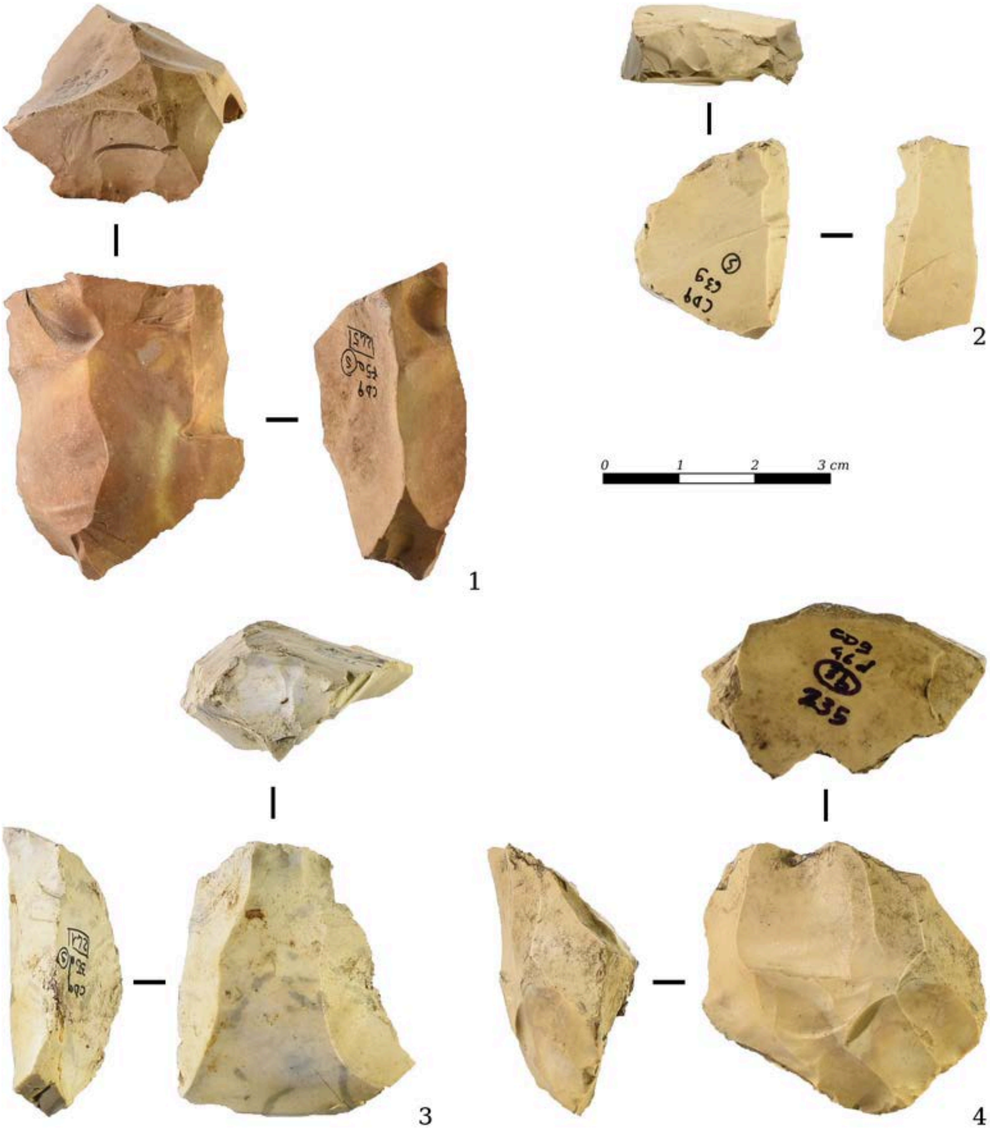

Figure 13.6: Cima XII, site CD9. Cores. 1 and 2 are cores on flakes.

13.5 Blanks selection and transformation

13.5.1 Microlithic armatures

Table 13.13: Cima XII, sites CD3, CD9. Blanks selected for the production of microlithic armatures.

	CD3		CD9	
Bladelets	21	20.6%	12	15.2%
Bladelets/flakes	72	70.6%	56	70.9%
Laminar flakes	1	1.0%	1	1.3%
Cortical bladelets	1	1.0%		
Semi-cortical bladelets	1	1.0%	4	5.1%
Flakes	5	4.9%	6	7.6%
Burin spalls	1	1.0%		
Total	102	100%	79	100%

Although in most cases the reduced size of microliths prevented the identification of the blank type, it can be surmised that for their manufacture bladelets and flakes were preferentially selected (Table 13.13). The use of cortical and semi-cortical bladelets is also attested, along with that of a burin spall.

Microliths were shaped out by means of invasive abrupt direct retouches. At CD3 also bipolar retouch was used quite often, both for backed points and triangles. The use of the microburin technique is attested by a high number of wastes (Table 13.14) and the presence of residual portions of *piquant-trièdres* on the microliths. These latter, in particular, attest that the microburin technique was applied for the production of both backed points and triangles. Proximal microburins are more numerous than distal ones and their number surpasses that of microliths. This allows supporting that this technique was applied at first for removing the thicker part of the blank (i.e. the butt-and-bulb portion). As suggested by the presence of double *piquant-trièdres* on some triangles, the microburin technique could also be used to fractionate the blank at the desired length. The fragment thus obtained was then modified by abrupt retouch and shaped out. Longer bladelets could be sectioned into 2 or more portions as testified by the presence of a few double microburins.

Table 13.14: Cima XII, sites CD3, CD9. Wastes of the transformation phase.

	CD3		CD9	
Proximal microburins	139	42.2%	73	51.0%
Distal microburins	113	34.3%	49	34.3%
Double microburins	3	0.9%	3	2.1%
Undetermined microburins	15	4.6%		
Fractured notches	17	5.2%	7	4.9%
Krukowski microburins	13	4.0%	4	2.8%
Retouch flakes	29	8.8%	7	4.9%
Total	329	100%	143	100%

Table 13.15: Cima XII, sites CD3, CD9. Microlithic armatures.

	CD3		CD9	
Backed points	7	6.9%	7	8.9%
Sauveterre	*5*	*4.9%*	*3*	*3.8%*
natural base	*2*	*2.0%*	*4*	*5.1%*
Crescents	1	1.0%		
Scalene triangles	16	15.7%	18	22.8%
Isoscele triangles	4	3.9%	3	3.8%
Backed bladelets			1	1.3%
Backed-and-truncated bladelets	1	1.0%		
Backed fragments	63	61.8%	45	57.0%
backed fr.	*44*	*43.1%*	*29*	*36.7%*
pointed backed fr.	*5*	*4.9%*	*5*	*6.3%*
double backed fr.	*7*	*6.9%*	*3*	*3.8%*
pointed double backed fr.	*2*	*2.0%*	*1*	*1.3%*
backed-and-truncated fr.	*5*	*4.9%*	*7*	*8.9%*
Under construction	10	9.8%	5	6.3%
Total	102	100%	79	100%

With respect to microburins, microliths are not particularly abundant and mostly represented by backed points, triangles and backed fragments (Table 13.15; Figure 13.7; 13.8). Among backed points needle-like Sauveterre points and larger backed points with natural base are attested. The former generally display double totally backed sides and in some cases also 2 pointed ends (3). Dimensional values range between 22 and 9 mm in length, 2-3 mm in width and 1-2 mm in thickness. On the other hand, points with natural base generally present a pointed end shaped out with an oblique straight and partial retouch. In 2 cases a complementary retouch is attested and in 1 a double back.

Triangles are attested both by scalene and isosceles types, the former being predominant. At CD3 these generally present unmodified third sides (Table 13.16) and only in three cases partial semi-abrupt retouches are attested. At CD9 the number of pieces featuring a complementary retouch is slightly higher and two artefacts with a completely backed third side are also attested. Also two isosceles triangles belonging to site CD9 present a complementary retouch. Another difference between the two sites can be identified in the dimensions of triangles (Table 13.17). While width and thickness are comparable those from CD3 are much longer: their minimum value, 12 mm, almost corresponds to the maximum value of CD9 (13).

The other geometric microliths are represented by one crescent, actually featuring sub-angular edges, one backed bladelet and one backed-and-truncated bladelet. The numerous fragments can be associated to one of the above mentioned types.

Furthermore, some unfinished artefacts are also attested. These generally present partial retouches, abruptly interrupted and occasionally associated to possibly technological fractures.

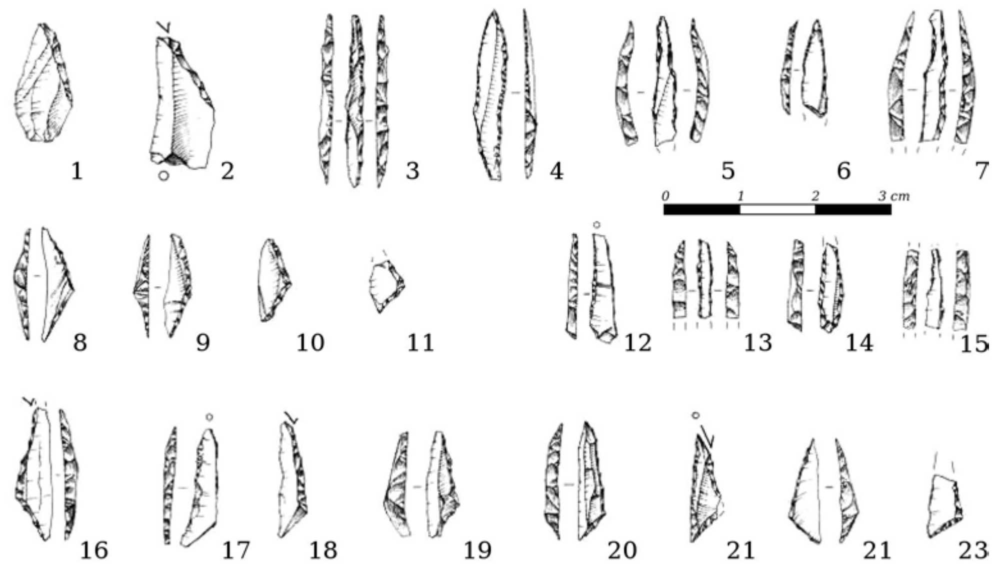

Figure 13.7: Cima XII, site CD3. Microlithic armatures: 1-7, backed points; 8-11, 16-23, triangles; 12, backed bladelet; 13-15, backed fragments (after Broglio et al., 2006).

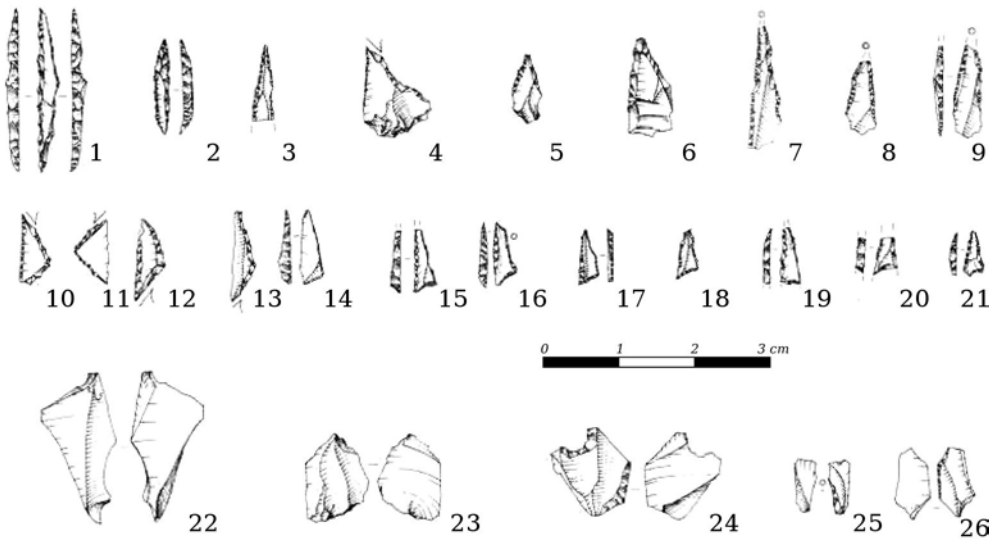

Figure 13.8: Cima XII, site CD9. Microlithic armatures (1-21) and microburins (22-26): 1-9, backed points; 10-21, triangles; 22-26, microburins (after Broglio et al., 2006).

Table 13.16: Cima XII, sites CD3, CD9. Morphology of the third side of scalene triangles.

	CD3		CD9	
Backed third side			2	11.1%
Complementary retouch	3	18.8%	6	33.3%
Natural third side	13	81.3%	10	55.6%
Total	16	100%	18	100%

Table 13.17: Cima XII, sites CD3, CD9. Dimensional values of scalene and isosceles triangles.

	CD3				CD9			
	L	W	T	L/W	L	W	T	L/W
Min.	12	3	1	2.4	5	3	1	1.67
1st Qu.	12.5	4	1	3.13	8.25	3	1	2.5
Median	14	4	1.5	3.5	9.5	4	1	2.55
Mean	13.82	3.9	1.5	3.85	9.43	3.75	1.3	2.62
3rd Qu.	15	4	2	4.83	10	4	2	2.94
Max.	16	5	2	5.33	13	5	2	4
σ	1.4	0.55	0.51	0.98	1.95	0.72	0.47	0.56
Count	11	20	20	11	14	20	20	14

13.5.2 Retouched tools

Retouched tools (Figure 13.9, 13.10) were manufactured on a wider set of blanks including mostly flakes and laminar by-products (Table 13.18). These include both semi-cortical and naturally backed elements. Maintenance blanks were also selected as well as different types such as burin spalls. Initialisation blanks, apparently, were not used.

Burins are the most attested tool-type as far as site CD9 is concerned (Table 13.19). They were mostly manufactured on flake-like blanks, hardly reaching 40 mm. Most frequently naturally backed flakes were selected. Burins are generally simple or right angled dihedral. In some cases (2) straight truncations or fractures were exploited for detaching the burin spalls. In two of them multiple removals were attempted. In one case the plunging portion of a burin on fracture was used as striking platform for the removal of a second burin spall, presumably after the utilization of the first one. In the second multiple tool, a simple burin is opposed to one on truncation. This also attests the presence of 2 failed removals (2-3 mm long), one on the opposite end of the truncation, the other from the first burin facet (attempt to make a dihedral burin).

Endscrapers are attested only by 3 artefacts belonging to site CD3 and 4 to CD9. All of the two sites yielded both long and short types. The former were manufactured on flakes and semi-cortical flakes while the latter on laminar flakes and a semi-cortical blade. This is the largest one attested (68 x 25 x 6 mm). Only 3 endscrapers belonging to site CD9 feature lateral retouches.

Truncations were realized with direct, marginal or invasive, retouches, located on the distal end of both lamellar and flake blanks. The truncation is either oblique or right angled with respect to debitage axis. For their production relatively short blanks

Table 13.18: Cima XII, sites CD3, CD9. Blanks selected for the production of retouched tools.

	CD3		CD9	
Blades/bladelets	7	17.1%	3	8.3%
Laminar flake	7	17.1%	9	25.0%
Blades/flakes	5	12.2%	7	19.4%
Flakes	3	7.3%	4	11.1%
Laminar by-products	8	19.5%		
Flake by-products	6	14.6%	10	27.8%
Maintenance blades	1	2.4%	1	2.8%
Maintenance flakes	2	4.9%	1	2.8%
Different	2	4.9%	1	2.8%
Total	41	100%	36	100%

Table 13.19: Cima XII, sites CD3, CD9. Retouched tools.

	CD3		CD9	
Burins	5	12.2%	13	36.1%
Endscrapers	3	7.3%	4	11.1%
Truncations	5	12.2%	2	5.6%
Borers	5	12.2%	2	5.6%
Backed knives	3	7.3%	6	16.7%
Backed pieces	6	14.6%		
Backed fr.	8	19.5%	4	11.1%
Retouched pieces	3	7.3%	3	8.3%
Denticulates			1	2.8%
Notches	3	7.3%		
Mixed tools			1	2.8%
Total	41	100%	36	100%

were selected, the largest being a laminar flake of 45 x 25 x 5 mm. The other blanks are represented by bladelets and semi-cortical/maintenance flakes.

For the manufacture of borers laminar products and by-products as well as other elongated blanks such as a burin spall and a reorientation blade were selected. Retouch could either be marginal or invasive. In this latter case the natural morphology of the blank was exploited. Four borers present a *déjeté* point while the other three an axial one. Two of these latter are actually double borers.

Backed knives are attested in particular at CD9. They were retouched out of large, mostly laminar, blanks that can be reconnected to the first phase of the first reduction scheme. Only in two cases naturally backed flakes were selected, in the others blades and laminar flakes. Length values are comprised between 40 and 66 mm and width between 12 and 31. Blanks, in most cases (7), were only slightly modified with a marginal retouch. In the two remaining elements, retouch was respectively direct and bipolar.

Also the other tools featuring backed retouches are predominantly laminar elements with marginal modifications possibly related to either prehension or hafting. Two fragmentary elements probably were backed knives and 2 other borers. The same consideration can be proposed for pieces featuring semi-abrupt retouches. These often cover only a reduced portion of the edges and have a concave delineation.

Pieces featuring a denticulated edges are almost absent, but for one flake with a direct, distal, transversal denticulated retouch (CD9). Similarly isolated notches are rare being represented only by three artefacts belonging to site CD3. A single composite tool is attested at CD9. It is a semi-cortical flake in which a pointed end is opposed to a truncated one.

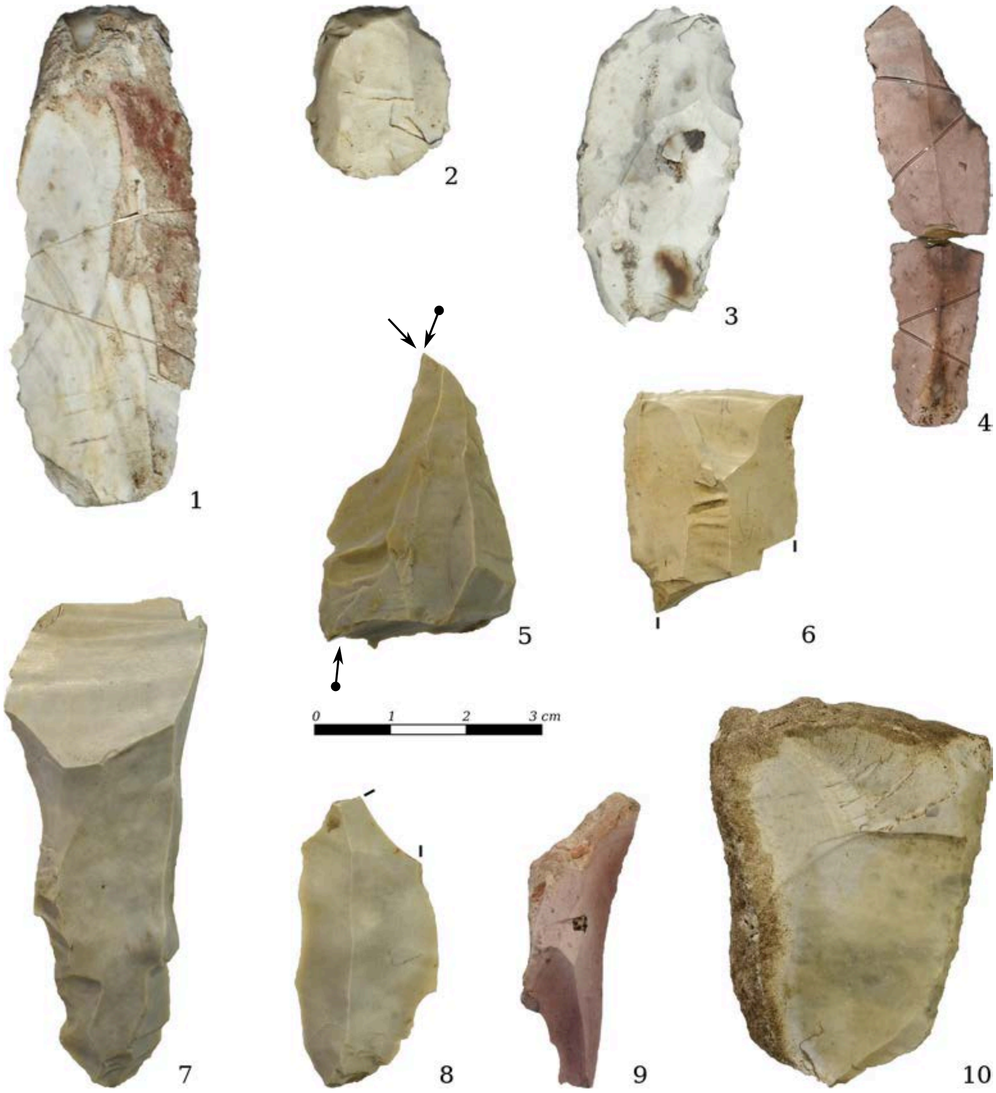

Figure 13.9: Cima XII, site CD3. Retouched tools: 1-2, endscrapers; 3-4, backed knives; 5, burin; 6, truncation, 7-8, backed pieces; 9-10, retouched pieces.

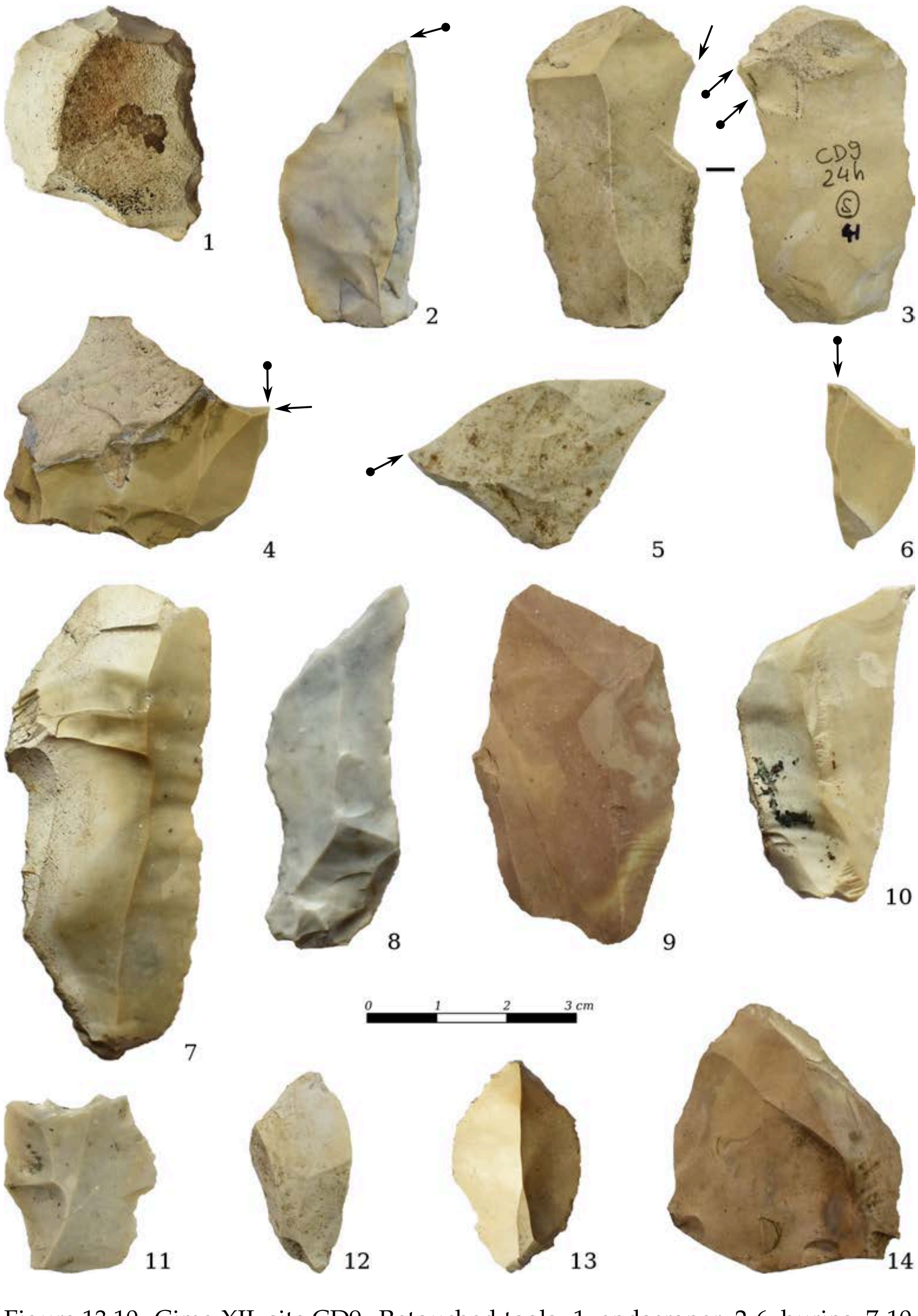

Figure 13.10: Cima XII, site CD9. Retouched tools: 1, endscraper; 2-6, burins; 7-10, backed knives; 11, truncation; 12-13, borers; 14, retouched flake.

Chapter 14

Casera Lissandri 17

Contents

14.1 Site introduction

Casera Lissandri 17 is one of the numerous Palaeo-Mesolithic sites discovered in the Cansiglio plateau, a limestone massif featuring a central *polje* (around 1000 m a.s.l.) encircled by ridges (1500 m a.s.l. high), which is situated between the Venetian and Carnic Pre-Alps (provinces of Treviso, Belluno and Pordenone) and enclosed by the drainage systems of the Piave and Livenza rivers (Visentin et al., 2016b). The site was identified in 1998 during a systematic survey campaign carried out on the western slope of the Piancansiglio (Figure 14.1) and was excavated during the following four years, from 1999 to 2002. The site is located on a gently sloped belt where the steepness is about 5-8°. Westward the gradient is much higher, while eastward it decreases to a flat zone corresponding to the bottom of the *polje* (more humid).

During the four field campaigns, an area of 23 m^2 was excavated and most of the site was explored, although, to the south, the presence of a fence limited the excavation. All of the artefacts longer than 2 cm were positioned during excavation, while the others were referred to a grid of 33 cm. Two clusters of artefacts, linked together by a good number of refitting assemblages, were brought to light (Peresani et al., 2009).

Under the organic horizon, the stratigraphic sequence is composed of a silty soil (unit Cl) containing the Mesolithic assemblage (Visentin et al., 2016b). Below, a

Figure 14.1: The western slope of Piancansiglio where numerous Mesolithic sites were identified.

silty-clayey paleosol (unit Ar) of variable thickness lies on the carbonatic bedrock, affected by the typical features of covered karst. This sequence is comparable to that examined at Casera Lissandri I, which recorded different pedogenetic events, from the Early Pleistocene with evidence of several ferralitic processes to the middle Holocene with clay and iron illuviation and up to present day with weak illuviation, ferrolysis and bioturbation (Di Anastasio et al., 1995).

One radiocarbon dating is available, made on a charcoal found dispersed in unit Cl (Table 14.1). It allows dating the settlement to the mid Preboreal.

Table 14.1: Casera Lissandri 17. Available radiocarbon dating.

Layer	Lab. ID	Material	Radiocarbon age	Calib. age BP (2σ)
Cl	Poz-9919	Charcoal	9410±50	10,757-10,511

14.2 Lithic assemblages

The lithic assemblage brought to light during the excavation campaigns is composed of 11,178 lithic artefacts, including those recovered after dry sieving (Table 14.2). 8676 of them are represented by flakes and fragments smaller than 1 cm that were only counted without being separated in classes or by raw material. The attribution of raw material groups to the geological formation of origin was carried out by S. Bertola and use-wear analysis of a sample of artefacts by S. Ziggiotti (Visentin et al., 2016b).

Considering that the numerous fragments and flakes smaller than 1 cm compose the largest part of the undetermined elements and that these can be associated to an intense on-site knapping activity the assemblage presents a good preservation state.

Table 14.2: Casera Lissandri 17. Composition of the lithic assemblages.

Cortical and semi-cortical blanks	227	2.0%
Laminar blanks	322	2.9%
Flake blanks	468	4.2%
Maintenance blanks	163	1.5%
Burin spalls	60	0.5%
Undetermined fr. & flakes < 1 cm	9103	81.4%
Retouched blanks	413	3.7%
Transformation wastes	373	3.3%
Cores	49	0.4%
Total	11,178	100%

36.7% of the artefacts entered in the database are entire and 7.6% incomplete (Table 14.3). The number of burnt artefacts is attested at 21.2% (Table 14.4) while patinas and macroscopic edge damages are rare.

Table 14.3: Casera Lissandri 17. Integrity of the artefacts entered into the database.

Entire	918	36.7%
Incomplete	190	7.6%
Fragments	1394	55.7%
Total	2502	100%

Table 14.4: Casera Lissandri 17. Thermal alteration of the artefacts.

Unaltered	1972	78.8%
Altered	530	21.2%
Total	2502	100%

14.3 Raw material provisioning

The lithic resources exploited at the site are mostly represented by the cherts included in the different pelagic limestones deposited between the Friuli platform and the Belluno basin in the Cretaceous-Paleocene interval and outcropping in the area between the Cansiglio itself and Mount Grappa, in particular along the Belluno pre-Alps (Peresani and Bertola, 2010; Visentin et al., 2016b). The only exception is represented by a few rock crystal (quartz) artefacts belonging to the Alpine crystalline basement (Table 14.5). The largest outcrops are located in the western Tauern Alps, about 100 km to the North.

Chert slabs and blocks belonging to the Rosso Col Indes, Scaglia Grigia and Fadalto limestone formations, whose quality is not excellent, were collected in the surroundings of the site (5 km). The highest share of raw materials was collected in the low-mid Belluno valley, where the exposures of the Maiolica and Scaglia Rossa formations cover large belts along both slopes. 64 artefacts in Maiolica chert present different textural features which are consistent with the formations deposited above the Trento plateau. The nearest outcrops with these features are situated west of the Mt. Avena - Mt. Grappa alignment, around 45 km to the west as-the-crow-flies. Nevertheless, an even more western provenance cannot be excluded, as it is suggested by some reddish grey artefacts quite characteristic of the inner zones of the Trento platform, such as the Sette Comuni plateau.

Slabs and blocks were mostly collected in slope-waste deposits and soils, where they are abundant thanks to karst dissolution phenomena (Table 14.6). The use of some, possibly alluvial, cobbles is also attested.

Table 14.5: Casera Lissandri 17. Exploited lithologies.

Rosso Col Indes	54	2.8%
Scaglia Grigia	101	5.3%
Fadalto Limestone	6	0.3%
Soccher Fm	138	7.2%
Scaglia Rossa	1144	59.9%
Maiolica	459	24.0%
Rock Crystal	7	0.4%
Total	1909	100%

Table 14.6: Casera Lissandri 17. Collection context of raw material.

Slope deposit	226	56.2%
Alluvial cobble	4	1.0%
Soil	2	0.5%
Undetermined	170	42.3%
Total	402	100%

14.4 Reduction schemes

All the siliceous raw materials were processed according to a single reduction scheme. The flaking activity was aimed at the production of both bladelets and flakes (Table 14.7) whose length values clearly show a limit of 40-45 mm. For the production of these blanks both small cobbles and large flakes (60-90 mm) were flaked. Given the low number of cortical flakes and the small average size of the artefacts, none exceeding 48 mm in length, it can be surmised that the flakes were imported already knapped in the site. Furthermore, considering that these were almost exclusively produced with lithotypes outcropping in the Valbelluna and not with local varieties it is reasonable to believe that they were produced near the outcrops and then brought to the site along with small cobbles. In some cases these two types of blanks can be assimilated showing comparable sizes and similar morphological outlines.

Table 14.7: Casera Lissandri 17. Products and by-products.

Main products	**577**	**61.4%**
Blades	151	26.2%
Laminar flakes	39	6.8%
Flakes	387	67.1%
Laminar by-products	**192**	**20.4%**
Semi-cortical blades	55	28.6%
On the edge blades	10	5.2%
Semi-cortical on the edge blades	5	2.6%
Naturally backed blades	93	48.4%
Cortical naturally backed blades	29	15.1%
Flake by-products	**171**	**18.2%**
Semi-cortical flake	90	52.6%
Naturally backed flakes	48	28.1%
Cortical naturally backed flakes	33	19.3%
Total	940	100%

14.4.1 Initialisation

Debitage initialisation was mostly direct and exploited natural ridges and convexities (Table 14.8). The striking platform, during this early stage of the knapping process was often natural, located in correspondence of either a cortical or patinated surface. The preparation of crests is also attested by 4 elements. These did not modify intensively the original morphology of the blocks and were not standardized. Mostly they were just aimed at adjusting the longitudinal and transversal convexities. Two of them, in fact, are partial crested blades, while two others are total crested blades, one of which unidirectional. Additionally, part of the numerous burin spalls should, probably, be considered as initialisation elements of flake-cores.

Table 14.8: Casera Lissandri 17. Initialisation blanks.

Crested blades	2	2.6%
Partially crested blades	2	2.6%
Opening blades	3	3.9%
Naturally crested blades	11	14.3%
Opening flakes	6	7.8%
Generic cortical flakes	53	68.8%
Total	77	100%

14.4.2 Production

Cores were preferentially exploited unidirectionally for the production of laminar and flake products and by-products. These different classes appear in continuity as there is no clear difference between the modalities they were obtained with. Half of the bladelets attest length values comprised between 17 and 26 mm and width between 7 and 11 mm (Table 14.9; Figure 14.2). Laminar by-products are averagely longer while flakes are slightly smaller (median 14 and maximum value 32 mm). 58.3% of the bladelets feature a triangular cross-section.

Table 14.9: Casera Lissandri 17. Summary of the metric values of debitage products and by-products (A = blades, B = laminar by-products, C = flakes, D = flake by-products).

		A	B	C	D
Length	Min.	14	14	7	8
	1st Qu.	17	19.25	12	15
	Median	20	24.5	14	19
	Mean	22.43	26.47	14.81	21.22
	3rd Qu.	26	33	17	25
	Max.	43	46	32	48
	SD	7.31	8.69	4.98	9
	Count	63	78	200	116
Width	Min.	4	3	7	7
	1st Qu.	7	7	11	12
	Median	9	9	13	15
	Mean	9.63	9.97	13.78	16.82
	3rd Qu.	11	12	16	21
	Max.	38	27	36	45
	SD	4.28	4.15	4.22	6.74
	Count	188	185	268	163
Thickness	Min.	1	1	1	1
	1st Qu.	1	2	2	3
	Median	2	3	2	4
	Mean	2.14	3.52	2.33	4.29
	3rd Qu.	3	4	3	5
	Max.	7	10	7	13
	SD	1.01	1.74	1.15	2.52
	Count	189	188	287	169

At the occurrence of knapping errors or when the morphology was no longer profitable, surfaces were rejuvenated through removals from the same striking platform (mostly plunged) or from a lateral one (orthogonal) (Table 14.10). Otherwise cores were rotated in accordance with a non-standardized, pragmatic patterns as attested by some reorientation blades (mostly exploiting the overhang) and flakes. The use of an opposite striking platform is also attested. Maintenance of the striking platforms, on the other hand is limited and not systematic. The high share of naturally backed bladelets and naturally backed flakes attests their importance for an integrated maintenance of the debitage surfaces, in particular with facial exploitation methods.

For most production the adopted knapping technique is believed to be the direct percussion with a soft stone hammer. Additionally there is evidence of bipolar percussion limitedly to the exploitation of rock crystal. In particular an exhausted core and one flake (conjoining of two fragments) attest double, opposite impact points with the typical edge crushing connected to this technique. The only other artefacts in rock crystal are represented by 4 undetermined fragments. None of the chert artefacts features characteristics that could hint to a more widespread use of this technique.

At a general level, the complete reduction sequence is represented, but each

Table 14.10: Casera Lissandri 17. Maintenance blanks.

Neo-crested blades	4	2.5%
Partially neo-crested blades	8	4.9%
Proximal reorientation blades	7	4.3%
Distal reorientation blades	1	0.6%
Reorientation flakes	11	6.7%
Surface maintenance blades	10	6.1%
Naturally backed surface maintenance blades	1	0.6%
Surface maintenance flakes	40	24.5%
Maintenance flakes from opposite st. platform	6	3.7%
Striking platform maintenance flakes	11	6.7%
Generic maintenance flakes	63	38.7%
Total	163	100%

raw material group covers a fragmentary sequence, as a consequence of the partial exploitation of the cores at the site or within the excavated surface.

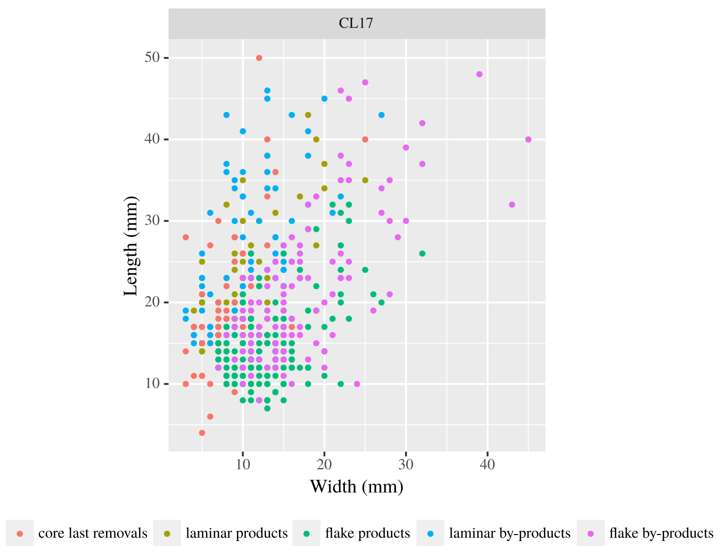

Figure 14.2: Casera Lissandri 17. Scatterplot of length and width values of products, by-products and core last removals.

Table 14.11: Casera Lissandri 17. Objectives of the production attested by cores.

Bladelets	27	55.1%
Laminar flakes	5	10.2%
Flakes	6	12.2%
Mix	3	6.1%
Undetermined	8	16.3%
Total	49	100%

Table 14.12: Casera Lissandri 17. Number and relative position of debitage surfaces.

One	31	63.3%
Two consecutive	5	10.2%
Two opposite	5	10.2%
Three or more	2	4.1%
Undetermined	6	12.2%
Total	49	100%

14.4.3 Cores

The lithic assemblage of the site included 49 cores (Figure 14.3). Additionally a flake-like slab that was probably brought to the site but not even tested should be mentioned (not included in the count). Core removals suggest that in most cases the aim of production was obtaining lamellar blanks, although also mixed and flake objectives are attested (Table 14.11). At least 21 cores were obtained from flakes. Nevertheless, the high incidence of this type could even be underestimated due to the problematic identification. These were mostly exploited as burin-like cores (16) (Figure 14.4). Striking platforms either exploited natural morphologies such as the flake butts or a distal plunging facet or were shaped out by detaching distal or proximal opening flakes (generally with a transversal stroke on the proximal or distal part of the blank, or occasionally on both). The reduction of these blanks started along the edge, with the removal of a burin spall along with series of bladelets featuring one or two natural backed edges, as testified by some short series of refitted elements, and sometimes developed to be narrowly facial. In other cases the ventral faces of the flake-cores were exploited for the production of small flakes or lamellar flakes with a facial mode. This modality is never associated to a prolonged exploitation of the cores. Slabs and cobbles were exploited either with wide facial or *semi-tournant* modalities. In some cases single debitage surfaces and striking platforms are attested (Tables 14.12 and 14.13). Otherwise, following core reorientations, two or more of them were exploited according to a wide set of combinations, mostly dependant on the morphology of the blanks. Some of the cores (3) are only tested cobbles while others were abandoned at the beginning of their exploitation (12). Most of them, anyways, were discarded during (22) or, less frequently, at the end (12) of their exploitation. Abandonment causes are mostly related to the presence of hinged removals on the debitage surfaces (22) or to raw material and volumetric problems (10).

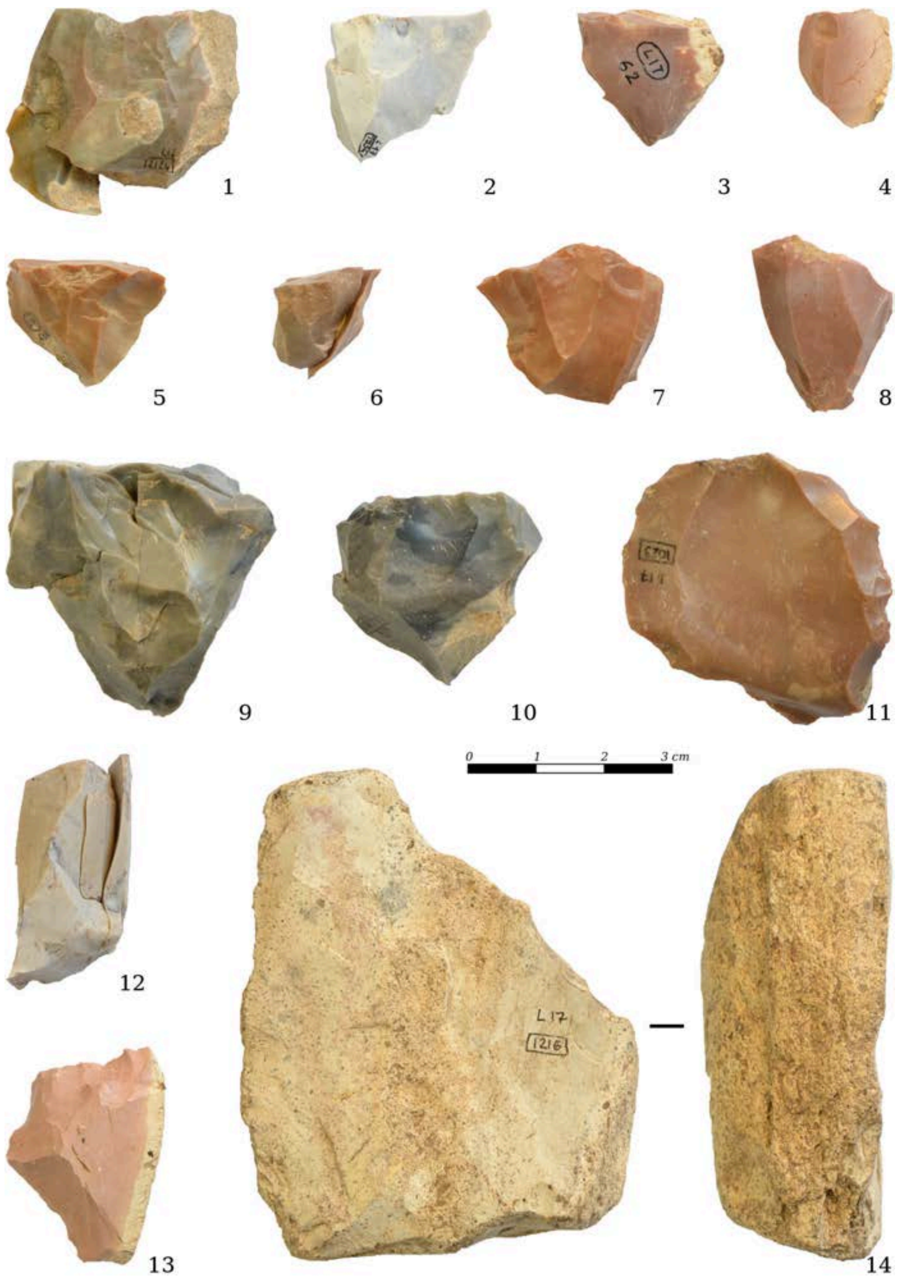

Figure 14.3: Casera Lissandri 17. Flake and bladelet cores. Number 1-4 attest the exploitation of flakes as core-blanks; 14 is an unexploited slab on local chert (after Visentin et al., 2016b).

Figure 14.4: Casera Lissandri 17. Refitting assemblages showing the exploitation of flakes as burin-like cores. In assemblage 1 the plunging end of the first burin spall was used to manufacture a tool (a burin associated to a notch). Assemblages 2-4 show continous sequences of burin spalls (after Visentin et al., 2016b).

Table 14.13: Casera Lissandri 17. Number and relative position of striking platforms (ds = debitage surface).

One	25	51.0%
One +1 secondary	2	4.1%
Two opposites - same ds	5	10.2%
Two opposites - diff. ds	1	2.0%
Two opposites - same ds +1 sec.	1	2.0%
Two orthogonal - same ds	2	4.1%
Two orthogonal - diff. ds	1	2.0%
Two orthogonal - same ds +1 sec.	1	2.0%
Three	3	6.1%
More than three	2	4.1%
Undetermined	6	12.2%
Total	49	100%

14.5 Blanks selection and transformation

14.5.1 Microliths

Table 14.14: Casera Lissandri 17. Blanks selected for the production of microlithic armatures.

Bladelet	28	8.1%
Bladelet/flake	274	79.2%
Nat. backed bladelet	13	3.8%
Cort. backed bladelet	1	0.3%
Semi-cortical bladelet	2	0.6%
Maintenance bladelet	1	0.3%
Flake	18	5.2%
Nat. backed flake	2	0.6%
Semi-cortical flake	1	0.3%
Cortical flake	3	0.9%
Burin spall	3	0.9%
Total	346	100%

Different types of blanks were selected and retouched for the production of microliths, although for the highest part it was not possible to determine the exact type. Attested evidence shows that along with bladelets and flakes also cortical, semi-cortical and maintenance blanks were selected (Table 14.14). Among by-products, elongated blanks with one natural backed side were preferentially selected. Although, in some cases being difficult to identify, these can be referred either to naturally backed elements or burin spalls.

The microburin technique was systematically adopted to fractionate the original blank, as suggested by the microburin/microlith ratio, near 1:1 (Peresani and Miolo, 2011; Visentin et al., 2016b). The technique was applied to all kinds of microliths (including backed points, triangles and crescents) and is also attested by a couple of truncated bladelets. Proximal microburins are more numerous than distal ones

(Table 14.15). In 94.8% of the former the notch was on the right side of the blank, in 91.8% of the latter on the left one. Also, double types are attested (n. 5). Presumably, the microburin technique was used first for removing the butt, which is the most difficult part to retouch, and occasionally to shorten the bladelet by a distal microburin. The assemblage also attests that this cycle could be performed twice on the same blank if this was long enough. A couple of refitted microliths and microburins shows that selected bladelets were two to three times the width of the finished element (Figure 14.5). While the designed length was reached with the microburin technique, the lateral backing was achieved by fine retouching. Two unfinished backed points suggest that one of the possible methods adopted for preparing such needle-like points required to perform the bilateral backing without modifying the proximal part of the blank in order to facilitate prehension during the shaping out phase. The butt was removed or reduced by retouch only at the end of the process. In 3 cases backed points were manufactured on transversal sections of flake blanks by direct backing.

Table 14.15: Casera Lissandri 17. Wastes of the transformation phase.

Proximal microburins	154	41.3%
Distal microburins	85	22.8%
Double microburins	5	1.3%
Undet. microburins	32	8.6%
Fractured notches	27	7.2%
Krukowski microburins	17	4.6%
Retouch flakes	53	14.2%
Total	373	100%

Table 14.16: Casera Lissandri 17. Microlithic armatures.

Backed points	32	9.2%
Sauveterre	*24*	*6.9%*
natural base	*8*	*2.3%*
Crescents	39	11.3%
Scalene triangles	47	13.6%
Isoscele triangles	25	7.2%
Backed bladelets	8	2.3%
Backed-and-truncated bladelets	2	0.6%
Backed fragments	173	50.0%
backed fr.	*110*	*31.8%*
pointed backed fr.	*16*	*4.6%*
double backed fr.	*10*	*2.9%*
pointed double backed fr.	*28*	*8.1%*
backed-and-truncated fr.	*9*	*2.6%*
Under construction	20	5.8%
Total	346	100%

Also from a typological point of view there is a high variability of attested types (Table 14.16; Figure 14.6). Most backed points are elongated Sauveterre-like types.

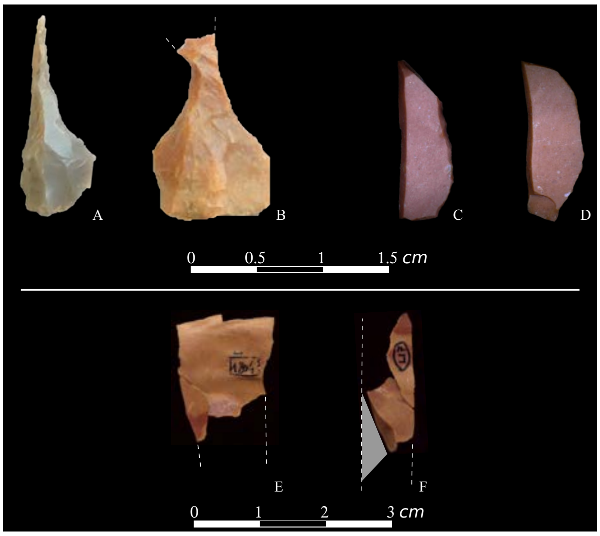

Figure 14.5: Casera Lissandri 17. A-B, Double backed points aborted during shaping; C-D, crescents shaped out of naturally backed bladelets, possibly burin spalls; E-F, refitting assemblages of triangles and microburins showing the original size of the blank, from two to three times the width of the microliths (the grey triangle represents a hypothetical missing microlith) (after Visentin et al., 2016b).

Table 14.17: Casera Lissandri 17. Morphology of the third side of scalene triangles.

	Scalene triangles		Isosceles triangles	
Backed third side	20	42.6%	12	48.0%
Complementary retouch	9	19.1%	4	16.0%
Natural third side	18	38.3%	9	36.0%
Total	47	100%	25	100%

Additionally some points with natural base are attested, although some of them seem to be in morphological continuity with Sauveterre ones. 5 of them, on the other hand, clearly differentiate. These latter were mostly manufactured on the proximal end of plunged blanks and present length values of 16-8 mm and width of 8-4 mm. Sauveterre points are 19-9 mm long, 5-2 mm wide and generally 2 mm thick. At a general level 17 backed points were manufactured with double backed sides and 3 present a complementary retouch. Backing is most often total, in particular on Sauveterre types. 3 of them also feature 2 pointed ends.

Among microlithic barbs scalene triangles are the most represented type although crescents and isosceles triangles are also well attested. As regards triangles, the presence of a backed third side is common both on scalene and isosceles types (Table 14.17). Also 51.3% of the crescents present a, generally partial, complementary retouch. Triangles and crescents present similar dimensional values (Table 14.18). The latter are slightly more elongated than the former. Also between scalene and isosceles triangles there are not significative dimensional differences.

Other types of microlithic barbs attested in the lithic assemblage by a reduced

Table 14.18: Casera Lissandri 17. Summary of dimensional values of triangles.

	Crescents				Triangles			
	L	W	T	L/W	L	W	T	L/W
Min.	7	2	1	1.94	6	2	0.9	1.5
1st Qu.	8.88	3	1.5	2.71	8.5	3	1.5	2.5
Median	10	3.5	2	3.2	9.25	3.5	2	3
Mean	10.69	3.47	1.75	3.17	9.96	3.47	1.77	2.9
3rd Qu.	12	4	2	3.63	11	4	2	3.24
Max.	17.5	5	2.5	4.25	16	5	3	3.86
σ	2.69	0.77	0.49	0.61	2.27	0.66	0.43	0.51
Count	32	38	39	31	66	72	72	66

number of artefacts and fragments are backed and backed-and-truncated bladelets. These elements present a high variability, being realized by either a marginal or invasive retouch that modified a single lateral side, a lateral and a transversal one or even two lateral and a transversal one. Finally 20 elements present partial abrupt retouches and, most likely, represent unfinished microliths.

14.5.2 Retouched tools

Retouched tools represent a small proportion of the entire lithic assemblage (Figure 14.6), in particular with respect to microliths (65 vs. 346). Most of them were manufactured on flakes and flake by-products (Table 14.19). Less frequently also lamellar blanks were used along with few initialisation and maintenance blanks. There does not seem to be any differences in selected blanks between the different tool types.

Four burins were realized starting from a truncation (either right angled or oblique), one is a right angled dihedral burin while the others are either simple types (2) or present a burin spall detached from a fractured surface (1). Most endscrapers are short types, with (1) or without (4) lateral retouches. The others are represented by a long endscraper and three nosed ones.

Tool types featuring a long non-retouched cutting edge such as truncations and backed knives are also well attested, in particular the former (Table 14.20). All truncations present an oblique distal retouched edge, while backed knives are characterised by a convex, totally or partially retouched lateral edge. An axial borer was manufactured on the distal portion of a naturally backed bladelet. The other tool types present discontinuous abrupt retouches, mostly marginal, or, less frequently, denticulated edges. Isolated notches are also abundant. Additionally a naturally crested blade was used as blank for a splintered piece.

14.6 Use and wear

Functional analysis was carried out by S. Ziggiotti on a sample of 453 artefacts, including 239 microliths, 74 microburins, 36 retouched tools, and 104 debitage products (Peresani et al., 2009; Visentin et al., 2016b). A protocol based on a low power approach was adopted, as the high power one did not allow identifying any use-wear micro-traces. This is probably due to surface alterations but could also be a consequence of non-intensive utilization.

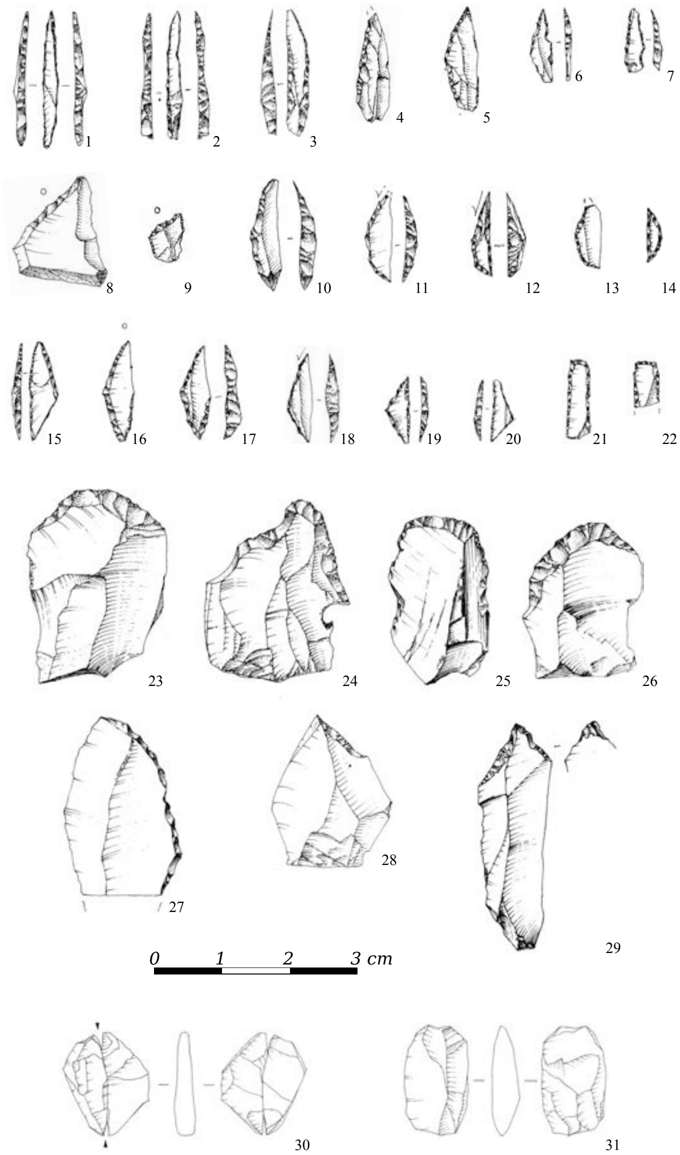

Figure 14.6: Casera Lissandri 17. Lithic industry: 1-2, Sauveterre-like points; 3-9, backed points; 10-14, crescents; 15-20, triangles; 21-22, backed-and-truncated bladelets; 23-26, endscrapers; 27, backed knife; 28, truncated bladelet; 29, borer; 30, rock crystal bipolar percussion flake; 31, rock crystal bipolar percussion core (Drawings by G. Almerigogna) (after Visentin et al., 2016b).

Table 14.19: Casera Lissandri 17. Blanks selected for the production of retouched tools.

Blades/bladelets	10	15.4%
Laminar flake	5	7.7%
Blades/flakes	3	4.6%
Flakes	18	27.7%
Laminar by-products	8	12.3%
Flake by-products	10	15.4%
Initialisation blanks	2	3.1%
Maintenance flakes	6	9.2%
Total	65	100%

Table 14.20: Casera Lissandri 17. Retouched tools.

Burins	10	15.4%
Endscrapers	9	13.8%
Truncations	9	13.8%
Borers	1	1.5%
Backed knives	2	3.1%
Backed pieces	11	16.9%
Backed fr.	9	13.8%
Denticulates	2	3.1%
Denticulated fr.	1	1.5%
Notches	10	15.4%
Splintered pieces	1	1.5%
Total	65	100%

14.6.1 Microliths

Backed points record a utilization rate of 15.3% (11 out of 72 examined). Use-wear includes impact damages such as bending/step fractures and burinations as well as edge scarring. The evidence confirms that the backed points were hafted on the very tip of the shaft, as perforating implements. 9 triangles and 1 crescent (13.5%) show small, step-terminating, bending fractures or burinations on one or both of their tips. Remaining fragments of microliths display an ephemeral rate of utilization (7.2%). At the general level, the percentage of diagnostic impact traces is low. Although this might be the consequence of an underestimation of used blanks due to the high presence of undetermined fractures, the utilization of microliths as projectile elements does not seem to be the main cause of their fragmentation; in contrast, other causes would play an important role, for instance technological fractures deriving from producing and/or repairing projectile elements (Visentin et al., 2016b).

14.6.2 Retouched and unretouched tools

Only 10 retouched and 11 unretouched tools yielded functional traces, corresponding to 22 active edges and 2 hafting areas (Visentin et al., 2016b). Use-wear evidence can be mainly attributed to animal raw materials processing. 6 tools, among which two truncations, were used to cut soft animal tissues during butchery. The rounding of one of the edges of a burin is also related to contact with soft animal materials. Such an activity was carried out before the removal of the burin spall, that may thus be interpreted as a rejuvenation removal. Three unmodified blanks attest wood scraping while the only borer was used on an undetermined material. As for endscrapers, three present rounding and scarring due to contact with leather (2) and fresh skin (1), while another was used for boring hard materials. The presence of abrupt lateral scarring allowed detecting two potential hafting on a couple of endscrapers. In general, use-wear traces on tools are rare and not well developed; this seems to point to their ephemeral use either in connection to short-term activities or expedient tasks.

Chapter 15

Discussion

Contents

In order to verify the existence of diachronic and regional trends characterizing the Sauveterrian of southern France and northern Italy, the studied assemblages were divided into 4 main geographic areas: south-western France, south-eastern France, the Venetian area and the Emilian one (Figure 15.1).

As regards south-western France the stratigraphic sequences of Rouffignac and Fontfaurès cover most of the Sauveterrian, with the exception of the recent phase (cf. Figure 15.2). In south-eastern France only the sequence of Montclus was studied that, on the contrary, attests only the recentmost Sauveterrian phase (from around 9500 cal BP onwards). Fortunately very detailed data are available for this area from other four settlements that allow covering the previous centuries (cf. Appendix A): Le Sansonnet, Les Agnels, Pey-de-Durance (Guilbert, 2000, 2003) and La Grande Rivoire (Angelin et al., 2016). In the Emilian area Collecchio is dated to the Preboreal and the lithic scatter VII of Le Mose to the recent part of the Sauveterrian. For the other lithic scatters of Le Mose, Casalecchio, Rubbiano and Longaròla no radiocarbon dating is available. On a techno-typological base for Casalecchio an attribution to the Boreal was proposed while for I.N.F.S. to an early Preboreal phase (Fontana and Cremona, 2008). In the Venetian area the only radiocarbon dated site is Casera Lissandri 17 (mid Preboreal) while level 7 of Grottina dei Covoloni de Broion (GCB) and the two sites of Cima XII (CD3 and CD9) are presumably to be related to a mid Sauveterrian phase.

With respect to functional aspects, because of the lower number of sites that was studied from this point of view due to both time and preservation constraints, the discussion will rely much more on bibliographic comparisons. Among them the most important reference is represented by the work of S. Philibert concerning four Sauveterrian sites of south-western France, Buhouloup, Abeurador, Balma Margineda and Fontfaurès (Philibert, 2002). Unfortunately I was not able to gain access to R. Khedhaier's PhD thesis (2003), focusing on south-eastern France and Switzerland. A few notions on this work could be obtained through citations by other authors. In

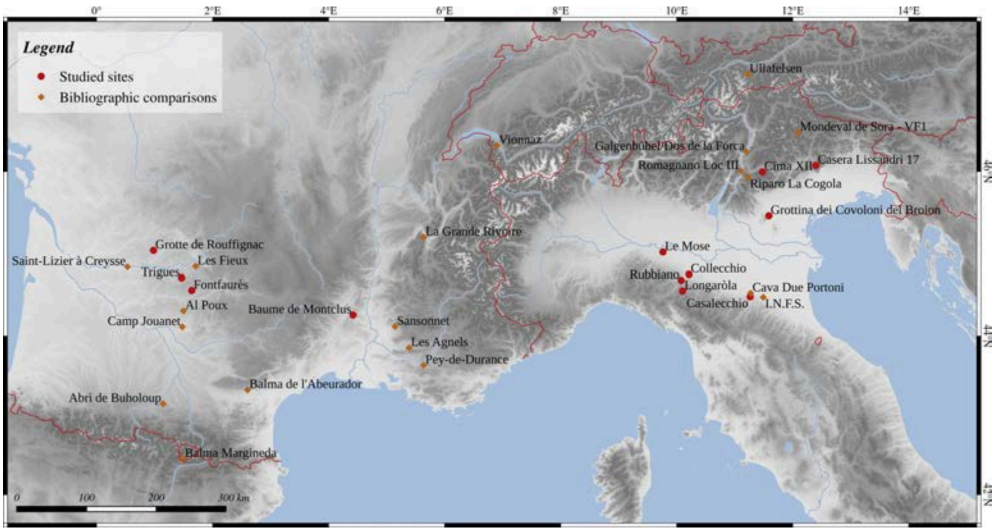

Figure 15.1: Location of the studied sites and of the main Sauveterrian assemblages mentioned in the discussion.

Switzerland functional data are available for the rock-crystal assemblage of Vionnaz (Pignat and Plisson, 2000). In the Italian side, the works of S. Ziggiotti (at Casera Lissandri 17 and Collecchio, in this latter case in collaboration with G.L.F. Berruti), C. Lemorini (Laghi delle Buse) and N. Mazzucco (Cividate Camuno) should be mentioned (Lemorini, 1994; Fontana et al., 2009c; Peresani et al., 2009; Martini et al., 2016a; Visentin et al., 2016a,b). Moreover important data concerning microlith assemblages comes from L. Chesnaux's thesis (2014a) and, concerning northern France, from the work of C. Guerèt (2013b; 2013a).

15.1 Raw material procurement

As regards raw material procurement, almost all the Sauveterrian assemblages that underwent detailed petrographic analysis indicate short-to-mid distance strategies. In particular exploited raw materials were collected in a radius of maximum 60 km from the sites. Although this general trend seems to unite the entire studied area, the nature of collected raw materials vary significantly in terms of lithology, size and morphology. Up to a certain degree this variability is motivated by the local availability of silicified raw materials, but it also reflects deliberate procurement strategies. At one end of the spectrum of adopted strategies are cases such as Rouffignac and Le Sansonnet that are located in correspondence of chert outcrops of good quality. In the former one large nodules were collected either in primary or secondary position inside the cave and on the terraces surrounding its entrance. Available nodules are up to several decimeters large and this strictly local raw material represents the largest share of flaked materials. Although being an open air site, Le Sansonnet confirms this procurement modality (Guilbert, 2003).

At the other end are the sites that are not located in correspondence of chert outcrops. This, clearly, represents the most frequent case and includes most of the studied sites such as Fontfaurès and Montclus, Montagnana, Longaròla and Rubbiano,

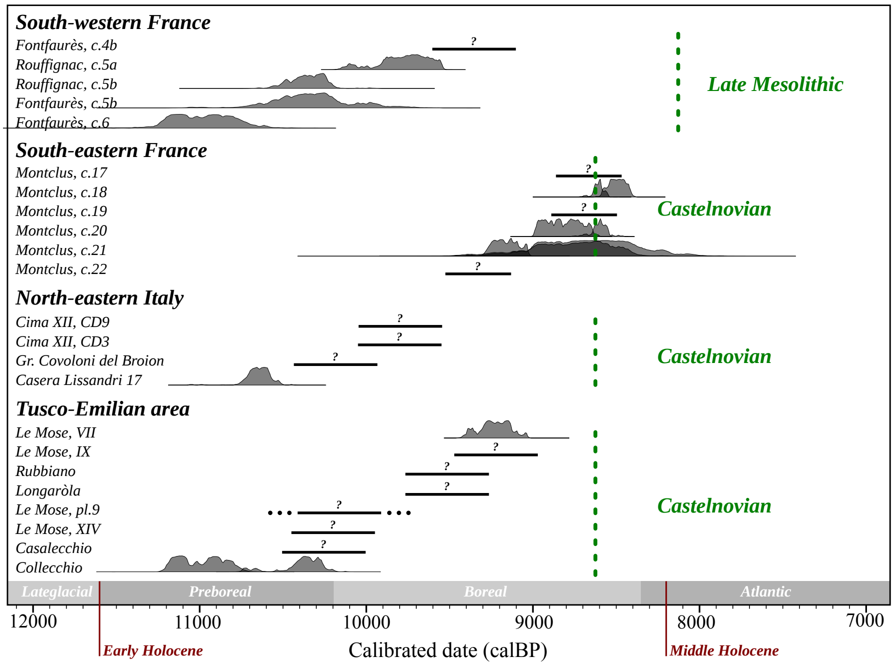

Figure 15.2: Chronological attribution of the studied sites on the base of radiocarbon datings (Appendix A) and/or techno-typological attribution.

Grottina dei Covoloni del Broion and Casera Lissandri. These sites attest the collection of nodules, cobbles and block fragments of small-to-medium size (no more than 10 cm, most frequently around 7 cm), belonging to a large spectrum of lithologies. As proposed for some of the Italian sites in which procurement strategies were analyzed in detail, it is likely that raw material procurement was embedded in other activities (e.g. hunting) (cf. Visentin et al., 2016b; Wierer and Bertola, 2016). In fact, the frequency and variability of lithologies attested at the sites often reflects the regional availability of knappable rocks and frequently raw material located closer to the site are less exploited than further ones of comparable quality, while the contrary should be expected in the case of a dedicated procurement (e.g. Casera Lisandri 17). Moreover the size of collected blanks allows an easy transportation over long distances, thus supporting this hypothesis. Nonetheless, more planned strategies related to long-term seasonal occupations (e.g. as it was proposed for Mondeval de Sora) cannot be excluded (Fontana et al., 2009c; Valletta et al., 2016). The complementary presence of more complex procurement strategies can also be surmised for some raw materials of exceptionally good quality. An example is the chert of Fumel, that is attested at Fontfaurès and Rouffignac but also, among other sites, at Camp Jouanet (Amiel and Lelouvier, 2003). Both at Fontfaurès and Rouffignac this raw material was exploited according to a much more curated debitage sequence.

Along with these two very different strategies, also intermediate cases are attested. This happens, for instance, at some of the Emilian sites such as Collecchio, Casalecchio and I.N.F.S. (Farabegoli et al., 1994). As it was observed also in other works (Fontana and Cremona, 2008; Fontana and Visentin, 2016) a peculiar feature of these sites is the exploitation of well silicified cherts along with partially silicified siltstone and limestones, according to different reduction schemes and with different objectives. While in the area of Bologna (I.N.F.S. and Casalecchio), where the (almost) only available good quality raw material is represented by small marine cobbles, the complementary use of large siltstone slabs could be seen as a choice dictated by natural constraints, the evidence from Collecchio allows confuting this hypothesis. In fact, the sector of the northern Apennines that extends between Parma and Piacenza is extremely rich in well silicified and, frequently, large-sized cherts. Nonetheless at Collecchio fine cherts were exploited along with radiolarites, partially silicified limestones and even lowly silicified siltstones. The latter raw material, in particular, was collected in the surrounding of the site as large flattish slabs that were exploited according to a dedicated reduction scheme and with a specific knapping technique. The dichotomy between cherts and the other raw material groups is furthermore highlighted by the fact that for microlith production only the finest lithotypes were selected. Collecchio, as well as the other sites of this region, attests, thus a combination of the two above mentioned strategies. A similar behaviour is attested also at La Grande Rivoire (Angelin et al., 2016). Furthermore, the differential use of raw materials, in particular in relation to microliths manufacture, was remarked also by Guilbert (2003) for the sites of the Vaucluse. The current evidence seems to indicate that this behaviour characterizes only these two regions, being unattested both westwards (south-western France) and eastwards (southern Alps).

Another example of intermediate strategy is represented by the two investigated sites of Cima XII. Although being located in highland areas of the Italian pre-Alps (around 2050 m a.s.l.), raw material outcrops are not far away (maximum 15 km). This proximity is reflected by the size of collected blocks and by reduction sequences. Cores, in fact, are rarely overexploited and the general dimensions of the production are larger than those of the other sites in similar locations but located much far away from raw material outcrops.

A common aspect to all the investigated sites is the extensive use of flakes as core-blanks. This aspect seems to be particularly attested in some Preboreal assemblages, such as level 5b of Rouffignac, Collecchio and Casera Lissandri 17, where the percentage of flake-cores is respectively 79%, 42% and 43%. Nonetheless flake-cores are attested in almost all the other studied assemblages with variable percentages, inferior to 30%. It is thus highly possible that this trend is actually biased by the studied sample. In fact, in most other sites cores are too few to allow a reliable assessment of this parameter. In some cases flake-core blanks were produced on-site, according to reduction schemes that will be discussed in the following subsection (e.g. Rouffignac, Montclus and Cima XII among others). In others they were produced outside the investigated area, as debitage blanks are not consistent with their size and/or there are none of the same raw material unit. Distance from raw materials outcrops is likely to be the discriminant factor between the two modalities. This latter case was clearly demonstrated at Casera Lissandri 17, but also at Collecchio as far as some of the raw materials are concerned (others, such as the radiolarite, were entirely exploited on-site). In the former site, the analogy, in terms of dimensions and morphology, of these flakes to some of the collected block fragments and slabs allowed surmising that they represent the ideal blanks for the production of bladelets and flakes to be retouched into microliths. Moreover, these blanks allow to optimize the volumetric exploitation not requiring any shaping out phase and are light enough to be easily transported. It should also be noticed that prior to their exploitation as cores, large flakes could be used for carrying out domestic activities as it was demonstrated by one of the refitting assemblages of Collecchio. In light of these premises, it would not be strange, although the lack of evidence does not allow to prove it, that (at least) part of these flakes were produced directly on the outcrops and then transported to the sites.

Occasionally raw materials collected at long distances are also attested but, most frequently, associated to finished objects or "peculiar" raw materials such as rock crystal. For example, in the eastern Alps rock crystal can be collected only in the inner sector (Tauri mountains) but its presence is attested also far from the outcrops, up to the pre-Alpine ridges as indicated by Casera Lissandri 17 (Visentin et al., 2016b). By contrast, in areas such as the inner Eastern Alps and the Western Alps that are characterized by metamorphic basements, the role of chert and rock crystal is reversed (e.g. Mount Fallère and Staller Sattel) (Raiteri, 2013; Kompatscher et al., 2016). In any case local raw materials are, generally preferred and most intensively (if not exclusively) exploited. Cases in which the majority of the raw materials were imported from long distances (around 100 km) exist but they seem to represent exceptional circumstances. The most eloquent example is represented by the Sauveterrian occupation phase of the northern Alpine site of Ullafelsen, attesting the exploitation of southern raw materials from the Adige basin (Non valley) (Schäfer, 2011; Schäfer et al., 2016).

15.2 Objectives of the production

Most of the sites that were analyzed in this work attest to a double objective for lithic raw material flaking. These objectives are better definable in metric terms more than morphological ones. In particular, on the one hand is the massive production of short and thin blanks, mostly destined to the manufacture of microliths. On the other are larger tools (up to 10 cm in length, most frequently shorter than 7 cm). As regards these latter, their presence in the archaeological assemblages is ephemeral, and often most of them were transformed into retouched tools. At Rouffignac, Fontafaurès (layer 6) and Cima XII these blanks correspond to blades, laminar flakes and laminar by-products (i.e. naturally backed and semi-cortical blades) and they were obtained during the first exploitation phase of an integrated lamino-lamellar scheme. The assemblage belonging to level 17 of Montclus, as far as this category is concerned, is almost entirely composed of (cortical) naturally backed blades suggesting that these represented the main aim of this production phase. As regards the Emilian evidence, at Collecchio and Casalecchio the necessity of obtaining large blanks was met thanks to the exploitation of coarser raw materials such as silicified siltstone and limestones. Emblematic is the case of Collecchio that attests the exploitation of a partially silicified siltstone according to a completely independent reduction scheme aimed at obtaining naturally backed flakes (30-75 mm in length). Its particularity is, furthermore, remarked by the adopted technique consisting of a perpendicular direct stone hammer percussion and of a preparation of the butt by means of short removals on the striking platform itself and not on the debitage surface. As far as I am aware of, this is the only evidence of such a reduction scheme in the Sauveterrian region. When analyzing the sites in which such a production is not attested, different scenarios can be highlighted. At the Grottina dei Covoloni del Broion raw materials were, evidently, overexploited, and all the larger blanks were transformed into endscrapers thus reducing even further the dimensional range of unretouched blanks. The only blanks that are referable to this large-sized production are two blade fragments that were brought to the site as flaked blanks as demonstrated in Chapter 12. This suggests that the production of large blanks was related to the site specificity and functional role as it was a production that was not systematically looked for. Taking into account the evidence from Casera

Lissandri 17, it seems that the production of large blanks is, similarly, absent as none of the products and by-products surpasses the 50 mm in length. Nonetheless it is interesting to note that tools that in other sites are manufactured on large blanks, such as backed knives, are attested but adapted to the smaller size of the production.

From a metrical point of view, the limit between the two productions is located around 35-45 mm in length. Below this threshold, that is confirmed also by the rare cores abandoned at the end of this first stage (cf. Montclus and Cima XII), at all sites, the production of bladelets and flakes was much more intense and systematic. By taking into consideration the first and third quartile of bladelets length distributions (cf. previous chapters), half of the bladelets produced in all the sites are comprised between 15 and 30 mm, with median values around 20-25 mm. A shift of this range towards larger values is attested, in particular, at Rouffignac and most likely it is due the local availability of lithic raw materials. This main production range seem to be confirmed also by other studied assemblages. As regards south-eastern France bladelets length values are reported to be respectively 35-40 mm, 12-30 mm and 15-30 mm at Le Sansonnet, Les Agnels and Pey-de-Durance (Guilbert, 2003). The first confirms the trend of the assemblages of Rouffignac. Similar values are reported also for the Italian series of Romagnano Loc III (Flor et al., 2011). Products attributable to this category are characterized by low thickness values, comprised between 1 and 3 mm. This is consistent with the main purpose of this production that is the manufacture of microliths. Width values, on the other hand are more variable and often, both by a morphological and metric point of view the traditional categories of bladelets and flakes are not easily distinguishable or even meaningless. The production or regular and elongated lamellar blanks is indeed attested, in particular related to burin-like cores or, more generally, to narrow debitage surfaces. At the same time the production of small flakes is undeniably attested by some cores, mostly exploited with facial schemes. Most of the cores, on the other hand, were exploited according to a volumetric concept in which the categories of wide bladelets, laminar flakes and flakes blend. This is the case, in particular, of the polyhedral and prismatic Sauveterrian cores that are often addressed as "pragmatic" (Walczak, 1998).

15.3 Reduction schemes

The reduction schemes for the production of the largest blanks are difficult to reconstruct as pieces referable to this debitage phase are generally few, both in terms of products and initialisation/maintenance blanks. These latter were presumably used as cores in the following phases. In most cases it was hypothesized an initialisation modality similar to that used for smaller blanks. The low standardisation of these blanks, moreover, suggests that the production was not really systematic and aimed at the obtention of few elements with short series of (mainly) unidirectional removals. The only two assemblages in which this phase could be reconstructed in detail are the already mentioned siltstone series of Collecchio and level 17 of Montclus. Both of them, anyway, are not consistent with the evidence coming from the other sites and, thus, most likely represent exceptional schemes. In the former one large slabs (20 or more cm long, around 10 cm wide and 5-6 cm thick) were exploited on the smaller face using the external surfaces as striking platforms. Short series of removal (3-5 flakes) from the wider face were followed by orthogonal removals from one of the two adjacent surfaces, and so on. Also in the case of layer 17 of Montclus large and narrow slabs were exploited, but in this case, they were of fine and well silicified chert.

If necessary, striking platforms were opened with large laminar removals, along one of the narrow surfaces. A laminar debitage then started exploiting the full length of the cores. In particular, obtained blanks are mostly represented by cortical naturally backed, thick (averagely 5 mm) and plunging blades. Some of them attest bidirectional scars indicating the use of two opposite striking platforms. Cores length was reduced through the detachment of frequent *tablettes* or partial striking platform maintenance flakes.

For the production of the smaller sized blanks, along with the reduced cores belonging to previous phase, also other blanks were used. These were either represented by cobbles and slabs of appropriate size or by large flakes. When these flakes were not imported, they were produced at the beginning or the debitage process as they are often represented by cortical and semi-cortical flakes. Otherwise, as attested by the evidence of layer 5a of Rouffignac, large blocks could be heat-fractured by exploiting the thermal shock effect produced with a brief exposure to high temperatures. Fragments thus obtained, are generally not affected by macroscopic thermal alteration and sound enough to be flaked for the production of small blanks. Moreover most fragments obtained present a module, as well as morphological features, allowing their assimilation to large flakes (cf. Chapter 4), thus remarking once more the importance of such blanks in the economy of these Early Mesolithic peoples. The application of heat-fracturing technique was identified also at Le Sansonnet and surmised at Les Agnels (Guilbert, 2001). The rarity of this evidence does not allow yet to assess whether it represents a regional phenomenon or a more widespread one and if it characterizes a specific time-span (Preboreal?) or not. A possible use of this technique at the Colbricon sites was mentioned by Guilbert, but a publication confirming this hypothesis is still lacking. An interesting term of comparison, moreover, is represented by the Beuronian assemblages of southwestern Germany. Thermal alteration, in fact, is considered as one of the distinctive features of the local Early Mesolithic, with respect to previous and later periods. In this case thermal alteration was interpreted as the result of a heat-treatment for enhancing knapping suitability of raw materials (cf. Eriksen, 2006).

Flake-cores could be exploited according to three main modalities. The first is aimed at longitudinally exploiting the natural edges of the flakes for obtaining elongated, regular and naturally backed bladelets (burin-like cores). This modality is attested in almost all the sites although with different percentages. In the Italian Preboreal sites such as Casera Lissandri 17 and Collecchio it is by far the most attested. This modality was reported also in other sites such as Le Sansonnet and Les Agnels (Guilbert, 2003), Romagnano Loc III (Flor et al., 2011), Mondeval de Sora (Fontana et al., 2009c; Valletta et al., 2016) and Galgenbühel (Wierer, 2008; Wierer and Bertola, 2016). In this latter, flake-cores were partially shaped out with bifacial removals. Moreover this modality seems to be attested also at the end of the Palaeolithic (cf. Binder, 1980). With the second modality the striking platform was located in correspondence of the ventral face of the flakes and bladelets were detached on the dorsal side with a facial or semi-tournant rhythm (endscraper-like cores). This modality is particularly attested in all the French sites. At Rouffignac and Trigues it is almost the only way in which flake-cores were exploited. On the other hand it seems not to be attested in Italy during most of the Preboreal while being occasionally attested in later sites. It is possible that the differential use of these two modalities in Southern France and Northern Italy during the Preboreal is to be connected to the size of microliths, which are much larger and wider in the former country (cf. Section 15.4). Flakes convexities could also be exploited with a facial modality for the detachment of large and thin blanks, either on the dorsal or ventral face (or both). This type of core is quite widespread although attested by very few pieces. In the studied sites the products connected to this modalities are small flakes (often hinged). At Galgenbühel such modality is attested also for the production of elongated blanks (Wierer, 2008; Wierer and Bertola, 2016).

Small blocks and slabs, on the other hand, were exploited according to different schemes and modalities. In some cases a single striking platform was maintained until the abandonment of the cores. Otherwise multiple debitage surfaces and striking platforms could be used, as a consequence of cores reorientation. A real shaping out phase is not generally attested and debitage initialization was mostly based on the exploitation of the natural morphologies of collected blanks, such as convex surfaces and natural ridges.

By comparing the modalities in which the lamellar/flake blanks were produced some general trends can be highlighted. First of all, in all the sites this production seems to be essentially unidirectional. Cores with a single striking platform are generally the most abundant group representing between 40 and 60% of the total (at least in those assemblages that yielded a significant number of cores). The presence of cores with two opposite striking platforms exploiting a same debitage surface is attested in particular (but not exclusively) in the assemblages of Preboreal/Early Boreal age (Rouffignac, Fontfaurès layer 6, Collecchio, Casalecchio, Le Mose XIV, Casera Lissandri 17). Nonetheless this core-type is attested also in the recentmost layer of Montclus and at both sites of Cima XII that are supposed to be of a later chronology on a typological base. Between 10 and 30% of the cores, without chronological or regional distinctions, feature three or more striking platforms. The others are represented by a high variety of cores with two striking platforms. In the French sites *semi-tournant* exploitation modalities are attested more often (33-71%) than in the Italian ones (10-50%). Moreover all multilayered sites attest an increase along the stratigraphic sequence, although when comparing multiple sites it is difficult to confirm this trend because of the highly variable score of this parameter. Wide frontal exploitation is attested between 10 and 40% in all the assemblages. For the reorientation of cores, the ridges formed by the striking platform and the debitage surface or by this latter and the opposite face, were exploited. In the French sites, debitage surfaces and striking platforms were also frequently switched. In the Italian ones, on the other hand, this modality seems to be attested only in the recent phase (cf. CD9). In the Alpine area, furthermore, cores intensively exploited on two opposite surfaces up to their complete flattening are also attested (at the end of the exploitation each surface corresponded to the striking platform of the other). This modality is comparable with the second reduction scheme of Galgenbühel (Wierer, 2008), as is the chronology of the settlements (final Preboreal/Boreal). Core maintenance was mainly limited to the debitage surfaces. The transversal convexity, in particular in the case of frontal exploitation, was preserved through naturally backed removals, included in the debitage sequences. The longitudinal convexity was corrected with plunging and thick removals from the same striking platform used for debitage. Less frequently the detachment of maintenance flakes from the lateral or the opposite surfaces are also attested. Quite often, at the occurrence of knapping errors, generally consisting of hinged removals, cores were turned and not maintained. More elaborated maintenance operations such as the shaping out of (partial) neo-crests is attested by very few blanks per site. A general trend that seems consistent with all the investigated sites is that in the time frame corresponding to the Boreal, the maintenance of striking platforms gradually becames more important and more carefully curated as testified by the relatively high number of *tablettes* and partial striking platform maintenance flakes yielded by the assemblages of layer 17 of Montclus (32% of maintenance blanks) and Cima XII (respectively 20% and 27% at CD3 and CD9). The recentmost layers of the Montclus series (layers 19-17), in particular, mark a turning point in the general trend of microlithization attested since the final Lateglacial and resulting at the debitage level in the shortening of products and reduction of the regularity and elongation of products. Layer 17, in particular, attests a careful and standardized debitage for the production of regular lamellar blanks. Unfortunately it is the only studied context dated to this period and reliable technological bibliographic references are nonexistent. It is, thus, not possible to asses, for the moment, whether it represents a peculiarity of the site or an actual trend perceivable at a regional scale.

As regards percussion techniques the variability is quite limited. It is likely that at all the sites direct percussion and hammerstones were used. More variable was the type of gesture that was adopted. For larger and thicker removals the hammerstone was used with a linear motion and aimed at striking 4-5 mm inwards with respect to the overhang. Such a technique does not require for the overhang to be trimmed and thus this practice was only seldom performed. This resulted in the characteristic morphology of the butt-and-bulb area that led to the definition of the "*style de Rouffignac*" by Rozoy (1978). At Rouffignac and Montclus it was frequently used for the production phase, in particular as regards the laminar production. More generally it characterizes initialisation and maintenance blanks. On the other hand for the production of bladelets, laminar flakes and flakes hammerstones were used with a circular motion and aimed closer to the overhang that was more or less regularly trimmed. This allowed the production of thinner and more regular blanks. Along with this widespread techniques, at some sites the use of the bipolar percussion technique is also attested. Occasionally this technique could be used for opening round pebbles. It is the case, for example, of Fontfaurès and Casalecchio, but also of I.N.F.S. (Farabegoli et al., 1994). In other cases, it was applied at the end of the debitage process in order to overexploit available raw materials. This technique, in fact, allows the complete exhaustion of cores (even less than 1 cm in length), while obtaining blanks that, although irregularly shaped are as long as the core itself and relatively thick (cf. Visentin, 2014). With this aim it seems that it was applied at the Grottina dei Covoloni del Broion. Similarly the use of the bipolar percussion was identified also at Casera Lissandri 17 as testified by a rock crystal core and a few other fragments. The application of this technique seems to be quite recurrent in Sauveterrian assemblages, in particular where silicified raw materials are not abundant. For example in the sites located in the western Alps it was systematically applied as attested by the rock crystal assemblages identified at Mount Fallère (Raiteri, 2013), and also by Swiss ones (both in rock crystal and chert).

15.4 Manufacture and use of microlithic armatures

Studying Sauveterrian retouched artefacts is not an easy task. As regards microliths the reason is self-explicative: their reduced size, in particular that of the small geometric armatures. With retouched tools, the problem is identifying intentional retouches from taphonomic scarring and use-wear. For this reason the use of a stereo-microscope, when approaching this type of analysis, is fundamental and this is the methodology followed in this work.

During the last decades, typological studies allowed identifying the diachronic evolution of lithic retouched artefacts and in particular of microliths both in northern Italy and southern France (Broglio and Kozlowski, 1984; Barbaza et al., 1991; Valdeyron, 1994). Following these works, the first comparisons were also carried out although limited by the adoption of different typological methods and lists as already discussed in Chapter 2 (cf. Valdeyron, 1994, 2008a). In order to add new data for the discussion, a technological approach to the analysis of the transformation phase was adopted. In particular classifications were reduced to the minimum and *a priori* metric threshold completely avoided as they represent one of the most limiting factors of previous comparison attempts.

The earliest Sauveterrian levels of Southern France (cf. Rouffignac, l. 5b and Fontfaurès, l. 6 and 5b) are characterized by the presence of Sauveterre points, and backed points with natural or retouched base, along with (in order of importance) scalene triangles, crescents and isosceles triangles. At general level, the assemblages of north-eastern Italy present a similar composition. At Casera Lissandri 17, along with Sauveterre and backed points with natural bases, scalene triangles, crescents, isosceles triangles and backed-and-truncated bladelets are also attested (while points with retouched base are absent). In the Emilian area the composition of the assemblages is quite different as triangles are almost absent (cf. Collecchio). Along with Sauveterre points and points with natural base, crescents and backed-and-truncated bladelets are attested. Production methods are similar in all the three regions. Retouch was mostly direct, more rarely bidirectional, and the microburin technique was extensively adopted. Although nominally quite similar, some important regional differences can be highlighted. First of all the presence of large backed points featuring a concave retouched base in all southern France that, on the other hand, are completely absent in the Italian territory. Secondly triangles, both scalene and isosceles, present different dimensional ranges. In particular in the oldest phases, at Fontfaurès and Rouffignac triangles are much less standardized, often large sized (up to 25 mm) and generally wider than those attested at Casera Lissandri 17 (Table 15.1). Furthermore at the Venetian site 44% of triangles are characterised by three retouched sides and 18% present a partial complementary retouch. The third side of triangles is always unmodified in the assemblages of Rouffignac - layer 5b and Fontfaurès - layer 6. In layer 5a of the latter site, on the other hand, 52% of them present a partial retouch and 12% a totally backed third side. The presence of backed or backed-and-truncated bladelets, characterizes in particular the Italian assemblages, being attested both in the Venetian and Emilian area, while they are almost absent in southern France. Data reported for Provence, and in particular for Le Sansonnet, indicate the presence of highly microlithic assemblages that are related by Guilbert (2003) to an Italian influence. Nonetheless the presence of points with retouched base remarks the complementary presence of features typical of the French Sauveterrian. Moreover the presence of assemblages in which crescents are more abundant than triangles (formerly known as Montadian) allows relating this region to the Emilian area where such assemblages were also identified, e.g. Collecchio and I.N.F.S. (Fontana and Visentin, 2016).

The Sauveterrian sites of Boreal age attest some major changes in the composition of microliths assemblages, as it had been highlighted by previous studies (cf. Broglio and Kozlowski, 1984; Barbaza and Valdeyron, 1991). Among studied assemblages layer 4b of Fontfaurès and layer 21 of Montclus can be considered characteristic of this phase. In both of them geometric microliths are exclusively represented by scalene triangles. The morphology of their third side presents trends similar to those of the Italian Preboreal assemblages: at Fontfaurès and Montclus respectively 47% and 65% of triangles present a partial retouch in correspondence of the third side, mostly

Table 15.1: Dimensional values of the triangles belonging to the main Preboreal assemblages studied.

	Fontfaurès - L. 6				Rouffignac - L.5a			
	L	W	T	L/W	L	W	T	L/W
Min.	8	3	1	1.8	12	5	1	1.5
1st Qu.	9.6	4	1	2.1	12.25	5.25	1	2
Median	11	5	1.5	2.6	13.5	6.5	1.5	2.3
Mean	11.6	4.6	1.6	2.6	13.8	6.3	1.7	2.3
3rd Qu.	13	5	2	3	14.75	7	2	2.6
Max.	19	6	3	3.3	17	8	3	2.8
σ	2.928	0.957	0.629	0.5	1.941	1.211	0.816	0.468
Count	14	16	16	14	6	6	6	6
	Fontfaurès - L. 5b				Casera Lissandri 17			
	L	W	T	L/W	L	W	T	L/W
Min.	5	2	1	1.6	6	2	1	1.5
1st Qu.	8.3	3	1	2.3	8.5	3	1.5	2.5
Median	10	4	2	2.6	9.6	3.5	2	3
Mean	11	4.2	1.5	2.7	10	3.5	1.8	2.9
3rd Qu.	12	5	2	3.2	11	4	2	3.2
Max.	25	8	2	4.2	16	5	3	3.9
σ	4.29	1.27	0.507	0.6	2.269	0.657	0.429	0.513
Count	26	30	30	26	66	72	72	66

simple and marginal, and 11% and 24% of them respectively a completely retouched third side. Moreover the average dimensions decrease importantly and morphologies become more elongated (Table 15.2).

Table 15.2: Dimensional values of the triangles belonging to the main French Mid-Late Boreal assemblages studied.

	Fontfaurès - L. 4b				Montclus - L. 22-19				Montclus - L. 18-17			
	L	W	T	L/W	L	W	T	L/W	L	W	T	L/W
Min.	6	2	1	1.8	7	2	1	2.3	7	2	1	2.3
1st Qu.	8	3	1	2.3	10	2	1	2.9	11	3	1	3
Median	10	4	2	2.5	11	3	1	4	12	3	1	4
Mean	10	4.2	1.5	2.8	10.9	2.9	1.1	4.1	12.7	3.3	1.2	4
3rd Qu.	12	5	2	3.3	13	4	1	5.1	15	4	1	4.5
Max.	15	7	2	4.5	14	5	2	6.5	23	6	2	6.3
σ	2.708	1.411	0.512	0.809	2.043	0.95	0.232	1.294	3.546	0.647	0.417	1.065
Count	13	21	21	13	28	36	36	28	41	73	73	41

Among backed points, the same three types continue to be attested at Fontafaurès. At Montclus, on the other hand, backed points are few and mostly represented by proximal points with natural bases. From a technological point of view the most important change is that the microburin technique is no more attested (cf. Valdeyron, 1994; Guilbert, 2003; Chesnaux, 2014a,b). This change can be correlated with the use of small and regular blanks, mainly represented by bladelets and laminar flakes, that did not need to be shortened, but only laterally backed. This is highlighted by the fact that both triangles and backed points often present uncomplete points, still preserving a portion of the butt and/or of the distal end. As seen in the description of reduction schemes, level 17 of Montclus attests a turning point also in the progressive decrease of microlith size. Along with the small types, larger triangles (up to 23 mm in length) start to be produced again. These are still elongated types and among them, the presence of three totally retouched sides is predominant (68%).

In the Italian sites such a drastic change is not attested and the differences that characterized the Emilian and Venetian sites during the older phase disappear. At a general level the tendency of triangles to become more elongated (and consequently of the small base to shorten) is confirmed. Similarly the gradual decrease in the presence of crescents and isosceles triangles is also attested, while the morphology of the third side of triangles has very little meaning *per se*. Sites included in this work and attributed to this phase are few and yielded very few microliths. The only dated evidence is that of lithic scatter VII of Le Mose in which the only 2 triangles are scalene and elongated types with a modified third side. The same trend can be identified at Cima XII. In particular the higher average length/width ratio of triangles suggests a later age for site CD3 with respect to CD9. Much more solid evidence confirming this pattern was produced by the study of the assemblage of Mondeval de Sora, site III (Valletta et al., 2016). The microburin technique is still massively used for the production of both geometric microliths and backed points. Furthermore, the transformation of irregular flake blanks into microliths is quite common and, in general, as it was proposed by Fontana and Guerreschi (2009) more attention was dedicated to the shaping of microliths through backing than to the obtention of regular blanks (with the exception of their thickness). Although being present since the earlier Sauveterrian, or better since the Late Epigravettian (Montoya, 2004), this tendency is particularly attested in the mid-recent Sauveterrian phase of the Venetian area. At Mondeval de Sora, for example, numerous Sauveterre backed points were obtained on transversal section of flakes. In the Emilian area it does not seem to be as significant and with respect to southern France it is in total countertrend.

As concerns microlith functioning and hafting arrays, results obtained during the present work come, in great part, from two French sites (Montclus and Rouffignac), as all the Italian sites selected for use-wear analysis were characterised by very few microliths. Nonetheless the publication of numerous detailed works (including some of the sites studied from a technological point of view) allows a comparison to be carried out (cf. Lemorini, 1994; Pignat and Plisson, 2000; Philibert, 2002; Peresani et al., 2009; Chesnaux, 2014a; Visentin et al., 2016b).

At a general level, it seems that there is a unanimous consensus in attributing to these artefacts a primary function as projectile implements, as it is evidenced by the presence of impact fractures on all the types of microlithic armatures. Alternative uses are also attested. At Vionnaz, Pignat and Plisson (2000) report that some of the microliths were used as cutting tools. The same was proposed also for Les Fieux (Valdeyron et al., 2011), Mondeval de Sora (Fontana et al., 2009c) and Collecchio (Visentin et al., 2016a). The number of artefacts that yielded such traces is, anyways, limited and, in most cases they are related to the recycling of projectile implements for butchering caraccasses. The creation of *ad hoc* composite tools cannot be excluded, in particular as regards backed-and-truncated bladelets that attest a particularly uneven distribution in Sauveterrian assemblages (cf. Fontana et al., 2009c).

Current evidence indicates that both in southern France and northern Italy, there is no difference, from a functional point of view among the different types of geometric microliths (i.e. crescents, scalene triangles and isosceles triangles). Use-wear is generally localised on one (or both) of the 2 pointed ends and along the natural side. The comparison with dedicated experimental programs (cf. Philibert, 2002; Chesnaux, 2014a) seems to indicate their lateral or latero-distal hafting on the shafts.

As regards backed points the perforating function of the pointed end is confirmed. In particular, the large-sized points with retouched base and the points with natural base, such as the ones identified at Rouffignac, attest similar use-wear patterns. Most recurrently impact damage is localized on their apex and represented by bending fractures with long *languettes*, complex fractures and burinations. In some cases it is associated to basal fractures. In accordance with the hypothesis advanced for the other Sauveterrian sites, this aspect suggests that they were hafted as axial points or latero-distal elements (with the secondary points playing a retentive role). Sauveterre-like backed points are generally associated to an axial hafting modality (Philibert, 2002; Fontana et al., 2009c). The same is proposed for the very small points with natural base that are found associated to the scalene triangles in the Sauveterrian levels of Montclus. Fractures identified on these latter indicate violent impacts that produced *siret*-like and transversal fractures with spin-offs. Summarizing, current evidence does not allows perceiving any correlation between typological variability in microliths morphology and functionality. Different morphotypes seem to be interchangeable, both at the level of each sub-groups (e.g. different types of backed points and of geometric microliths) or between the two (backed points could be substituted by triangular microliths). For this variability a possible hunting specialization on different game was proposed (Chesnaux, 2014a) although this is not necessarily the only possible explanation.

15.5 The tools and their use

At a general level Sauveterrian lithic tools were described as *outils expédient* (Guilbert et al., 2006), meaning to highlight the low technical investment with respect to Late Palaeolithic assemblages both in their production and use. By comparing the studied assemblages it seems that this notion can be applied only to one part of the Sauveterrian lithic toolkits examined as for the other one specific and recurrent shaping out modalities and patterns of use suggest that they were not expedient at all. The main types of tool included in the studied Sauveterrian assemblages will now be described, trying to highlight their differential status. As already mentioned in Chapter 3, in order to simplify the typological classification of retouched tools for the comparison sake, the use of terms/categories with a functional implication (e.g. scraper) and of numerous sub-types was avoided or reduced as much as possible. Morphological criteria, in particular those describing how the piece was transformed through retouch (e.g. type and location) were preferred.

Starting from endscrapers the studied evidence indicates a complete lack of uniformity. In most cases their number is reduced to 1-3 artefacts or they are completely absent. A slightly higher number, although being not more significative percentually, is attested at Collecchio and Casera Lissandri 17 (respectively 6 and 9). At the Grottina dei Covoloni del Broion, on the other hand, 25 of them were identified, corresponding to the 66% of all retouched tools. With respect to previous typological studies the number of endscrapers of some of the analysed lithic assemblages was much reduced. In particular many of them were interpreted as cores in this work (as, by the way, it was supposed also by Barrière, 1972). This hypothesis, is consistent with the size of some of the blanks that were transformed into microliths with respect to those of the negatives on the above-mentioned endscraper-like cores but also with the lack of use-wear on the cores themselves, at least as far as I am aware of. By cross-referencing technological and functional data it seems quite safe to affirm that no such thing as a carinated denticulated endscraper exists (just to name the most emblematic definition), at least as regards the studied assemblages. Moreover, this problematic finds an interesting term of comparison in the Aurignacian assemblages (cf. Le Brun-Ricalens, 2005), with which the Sauveterrian share many "microlithic" traits (not only concerning endscraper-like cores but also burin-like ones, microlithic armatures, micro-lamellar production, etc.). Endscrapers were mainly manufactured on short blanks, mostly represented by by-products, initialisation or maintenance flakes. The low number of artefacts in most sites did not allow an evaluation of possible regional and diachronic trends. The endscrapers recovered at the Grottina dei Covoloni del Broion are all characterized by (almost) right-angled retouched edges forming wide fronts. Lateral retouches are occasionally attested. Two of them yielded macroscopic traces attesting their hafting (that can be supposed also for the others). Use-wear indicates a transversal action on soft/resistant materials. More in detail its distribution (decentered and with a limited distribution on the upper face), the poor rounding, the frequent resharpening and the small dimensions of endscrapers is consistent with the Konso fleshing modality with the hide on the ground reported by Beyries and Rots (2008). Such use-wear is quite different from that identified on half of the endscrapers of Balma Margineda (L. 6) that, on the other hand, are well rounded (at least two of them) and have worked dry hide with ochre or other abrasive materials (Philibert, 2002). A decentered distribution of polishes is attested also at this site. In other sites the non-systematic use of endscrapers for different activities is also reported. At Mondeval de Sora, for example, a few endscrapers were used to scrape hard animal tissues and wood (Fontana et al., 2009c).

Burins represent one of the most interesting tool-types as regards Sauveterrian assemblages. They attest, in fact, a complex life-cycle including multiple phases of use and resharpening. As for endscrapers the problem of their reconnaissance and distinction with respect to burin-like cores was encountered. In this case, anyhow, it was not easily overcome as morphological differences are not as clear as for endscrapers and the very existence and pertinence of a distinction between the two categories is questionable (cf. Chapter 8). Nonetheless the presence of burins used as tools is clearly attested by use-wear traces. Their higher presence, in fact, seems to be correlated, although not exclusively, to those assemblages that are less oriented towards cynegetic activities, such as Collecchio and Plinth 9 of Le Mose. The technological analysis of the numerous burins (50) yielded by the assemblage of Collecchio, in particular, allowed advancing the hypothesis that the burin technique was actually aimed, at least in some cases, at re-sharpening the active edge (Visentin, 2011). This was demonstrated with a systematic use-wear analysis carried out on burins and burin spalls which allowed identifying use-wear traces both on the lateral dihedrals formed by the burin facet and on the lateral margins of the burin spalls (Visentin et al., 2016a). This is confirmed also by the evidence of Le Mose, Casera Lissandri 17 and Rouffignac (among others). Sauveterrian burins can, thus, be preferentially considered as scraping tools, mostly dedicated to the working of mid-to-hard materials such as wood (Collecchio) and bone (Le Mose, pl. 9). From a typological point of view this class is highly variable. The morphology and the number of burin facets, in fact, is at least partly related to the intensity of use and number of re-sharpening attempts. The use of both truncations and natural surfaces as striking platforms is attested. This functioning modality is quite different from the "classic" one, most frequently proposed, for example, for Magdalenian contexts. This notion is not, anyhow, surprising in light of the high variability of use of this class of artefacts as it was recently highlighted by different works (cf. Tomàskovà, 2005; Plisson, 2006).

As regards tools modified with abrupt retouches, three main groups can be isolated in light of recurrent patterns: truncations, backed knives and borers. These latter were manufactured on different types of blanks, generally selected because of their fitting morphology.

Among studied sites, backed knives are attested only in French (Rouffignac) and Italian (C. Lissandri 17, Cima XII, Gr. dei Covoloni del Broion and Le Mose) assemblages dated to the early-mid phase of the Sauveterrian while they are absent in the following ones. Most frequently they were manufactured on large-sized, laminar blanks, belonging to the first production phases (first reduction sequence). The backing could be either straight or convex and either total or partial. In any case it seems that the functional edge was the natural one, opposite to the back. As already discussed, the presence of numerous backed knives at Rouffignac, some of which featuring two basal notches (hypothetically connected to a particular hafting modality), led to the creation of a specific tool-type known as Rouffignac backed knife (cf. Chapter 4). The analysis of this assemblage allowed confirming the existence of this specific type as well as clarifying its definition and morphological variability. This brought also to reconsider the territorial distribution of this tool. The presence of Rouffignac backed knives in some of the Italian assemblages, namely Romagnano (Broglio and Kozlowski, 1984) as well as other Venetian sites such as Cima XII (Broglio et al., 2006) and Galgenbühel (Wierer, 2007), is one of the features that was supposed to correlate the Italian and French Sauveterrian (Broglio, 2016). In spite of this, the Italian backed knives cannot be considered as Rouffignac types being too much different morphologically (selected blank, type of retouch) and not presenting real basal notches. The central area of diffusion of this tool-type can, thus, be considered to be western France, along the Atlantic Ocean (Gouraud, 1980; Gouraud and Thévenin, 2000) while the easternmost evidence comes from Ruffey-sur-Seille and Dammartin-Marpain, with one finding for each site respectively (Séara and Roncin, 2013).

Truncations attest a higher variability, both as regards manufacture and use. Blanks selected include both laminar and flake blanks as well as products and by-products. As for backed knives, to which part of them can be functionally assimilated, most frequently the active edge is represented by the natural lateral edge and it is used for longitudinal actions such as butchery. This was remarked at Fontfaurès, Abeurador, Buholoup and Balma Margineda (Philibert, 2002) and is confirmed also by the Italian evidence (Casera Lissandri 17) (Visentin et al., 2016b). Besides, a large spectrum of other activities is also attested (cf. Ziggiotti and Peresani, 2001; Peresani et al., 2002), among which the scraping of hard materials both using the natural edge and the retouched one (e.g. at Mondeval de Sora) (Fontana et al., 2009c). Transversal actions (on an undetermined materials) are attested also at Rouffignac. Furthermore, a thick truncated blade included in the assemblage of the Grottina dei Covoloni del Broion was used, on the retouched edge, for scraping either ochre or an ochred hard material.

Along with these tool-types, responding to a more or less defined and recurrent projectuality, a rich assemblage of pieces featuring semi-abrupt or abrupt retouches is attested in most sites. Retouches generally affect only limited portions of the edges and present either irregular or concave delineations. By comparing the two main regions it is possible to appreciate a preferential presence of semi-abrupt retouches, frequently inverse in the French sites, while in the Italian ones these are mostly abrupt and almost exclusively direct. Besides this “stylistic” variability, it seems that quite often these tools were not used in correspondence of the retouched edge but on the opposite one.

This allows their association at a morpho-functional level to unretouched tools that frequently present one cortical or naturally backed side. Following this line of thought it can be argued that the preferential use of natural edges implied a high degree of predetermination and projectuality during the debitage phase. The production of artefacts with morphologic features suitable to the execution of programmed tasks had to be accounted for since the earliest phases of the reduction schemes. This behaviour is well exemplified, for example, by the products of the first reduction sequence of layer 17 of Montclus, mostly represented by thick naturally backed blades. In this perspective evidence concerning the production and use of tools attests an opposite trend with respect to that generally highlighted for microliths which heavily relied on the transformation phase. The partiality of the functional evidence obtained in the framework of this thesis, both because of the preservation state of some assemblages and of the obvious time-constraints, does not allow a definitive assessment although it seems a working hypothesis worth investigating. Data supporting this hypothesis comes, for example, from northern France where the selection, and possibly production, of blanks featuring specific morphological features, i.e. regular and slightly concave natural edges, was demonstrated in association to the processing of plants (Gueret, 2013b). The same activity carried out with similar blanks was identified also in a Sauveterrian open-air site, Saint-Lizier à Creysse, by L. Chesnaux (Tallet et al., 2013).

Among other tool-types, a relatively high presence of denticulated pieces must be highlighted as regards French sites and in particular Montclus. In this category are included both artefacts reflecting a real attempt to modify the working edge for a functional purpose and pieces in which the retouch seems to be functional to prehension or hafting. Among the former some pieces from Montclus can be included, featuring carefully modified denticulated cutting edges that, unfortunately, yielded no use-wear traces. For one of the denticulated artefacts from Rouffignac, furthermore, it was surmised that the active zone was represented by the small point defined by two adjacent notches, a working modality that can find interesting comparisons with the Spanish *denticulados* (cf. Perales Barrón, 2015). Isolated notches are common in both countries but generally with a low numerical significance.

15.6 A concluding remark concerning technical systems

At a general level it is difficult to draw some conclusions (is it ever?) on lithic technical systems and tool functioning in the Sauveterrian region. Primary this is due to the fact that current evidence is still limited and partially biased by the functional specialisation of almost all the most significant sites, corresponding to sheltered settlements in which cynegetic activities play the dominant role. Nonetheless by enlarging sufficiently the region of investigation, available evidence allows perceiving and accounting for this functional bias. In this perspective the proposition that the Sauveterrian lithic assemblages reflect lowly developed technical systems (Philibert, 2002) should probably be softened. In fact, data above reported indicate a complex and versatile system, although lowly visible because of a high segmentation of reduction schemes, whose structure is possibly to be connected to the type of mobility of the human groups. Actually the technical background of Sauveterrian groups included a perfect knowledge of different knapping techniques allowing the obtention of large as well as of small blanks and of flexible systems for the processing of raw materials that could be based either on the short-term utilization of numerous blanks or on longer ones. The processing of vegetal materials over a long time span, for example, is documented at Rouffignac and Collechio, but also at Le Sansonnet (Khedhaier 2003, cited in Gueret 2013b), Saint-Lizier à Creysse (Tallet et al., 2013) and Lago delle Buse 2 (Lemorini, 1994). Furthermore the versatility of the Sauveterrian technical system is reflected also by the fact that the wide technical background of these hunter-gatherer-collectors groups is never fully expressed in a single site. The occasional exploitation of bipolar percussion in very different contexts, with a pattern that still escapes a full explanation, well exemplifies this concept. The most important achievement of Sauveterrian technology is, anyways, the almost complete independence from any constraints related to lithic raw materials, an achievement that is fundamental for the development of a capillary settlement settlement system (Fontana and Visentin, 2016). The flexibility of the technical system, in fact, allows the exploitation of locally collectable resources (e.g. rock crystal) and facilitates their transportation in regions devoid of knappable materials (flake-core exploitation methods *in primis*) thus also increasing the autonomy of groups. Nonetheless the segmentation of reduction sequences cannot be considered the only cause for the archaeological absence or underrepresentation of evidence regarding some processing activities. Different hypotheses can be advanced in this regards, both regarding perishable materials (wood? bone?) and macro-tools (cf. Plisson et al., 2008) but also social causes such as the sexual division of labour in relation to differential mobility patterns.

Chapter 16

Conclusions

Contents

Since the identification of the Mesolithic complexes in the Adige valley during the 1970ies, the inclusion of northern Italy and southern France in a unique cultural entity, the Sauveterrian, was proposed and sustained (Broglio, 1976, 1980; Kozłowski, 1975, 1976). A first typological attempt to verify the actual homogeneity of the Early Mesolithic of this region arose some doubts regarding the appropriateness of this unification (Valdeyron, 1994, 2008a). Following this line of research the main aim of this work was, thus, to question and verify this association. Such aim was pursued by applying a broad technological approach to the study of the lithic assemblages belonging to 23 stratigraphic contexts from 12 French and Italian reference sites. The assemblages, in particular, were studied in detail with the aim of reconstructing the entire reduction sequences, from the procurement of lithic raw materials to the use and discard of tools. The application of this type of analysis at a large scale allowed highlighting the complexity and the peculiarities of the lithic technical system of this Southern European region.

16.1 An Eastern and a Western Sauveterrian?

At a general level the two regions seem to respond to a same conceptual scheme and the lithic technical systems present numerous common traits. In both regions lithic raw material provisioning was essentially local reflecting short-to-mid distance displacements (generally less than 60 km) and in both regions very different raw materials were exploited. Reduction schemes were aimed at obtaining two main dimensional sets of products (although not always attested in all the sites) that, in extreme synthesis, can be related to the necessity to produce large-sized blanks to be used as tools (with or without previous transformation) and small blanks for the manufacture of microliths as well as of other tool-types. From a technological point of view, the methods adopted for producing these sets of products are quite similar, being both characterized by short sequences of unidirectional removals, frequent core reorientations, a massive use of large flakes as core-blanks and reduced maintenance procedures. At a functional level, both areas include sites reflecting the execution of different specific tasks although cynegetic activities appear omnipresent. Microliths functioned in similar ways as did tools. Both lithic systems seem to share the same rationale: an extremely optimized technology, not opportunistic in the least, but issued from a careful strategic planning, capable of exploiting differentially the spectrum of available resources and allowing an utter independence of Sauveterrian groups with respect to any constraint related to lithic raw materials. This flexibility does not apply only to lithic technical systems but was remarked also for other technical systems such as those of hard animal tissues (cf. Marquebielle, 2014).

Nonetheless, in the context of this generalized behaviour, a consistent variability can be found, marked mostly by differences that can be considered of “stylistic” nature (Figure 16.1). In this perspective the validity of microliths as primary indicators of regionalist trends seems to be reassessed. This diversification is particularly visible when comparing Preboreal assemblages. While some of these differences had already been highlighted by previous studies (cf. Valdeyron et al., 2008) such as the early presence of microliths retouched on three sides in Italian sites, others were blurred by the use of different typological systems. Among them are the presence in French sites of backed points with concave retouched bases (in all southern France) and large scalene or isosceles triangles (in particular in the south-west) that find no real correspondence in coeval Italian contexts. Furthermore, during this early phase, the Emilian and Provençal areas seem to be related by the presence of microlithic assemblages dominated by crescents and needle-like backed points. As previously pointed out production methods as well as hafting modalities do not display major differences. At a technological level a major difference can be found in the modality in which flake-cores were exploited: mostly as burin-like cores in the Italian settlements and as endscraper-like cores in the French ones. Significative differences are attested also by osseous industries as, for example, there is no evidence in the north Italian Sauveterrian of the use of wild boar inferior canines that, on the other hand, are frequently attested in France (Marquebielle, 2014). In this scenario it seems interesting pointing out the much closer affinity of French Sauveterrian assemblages to Beuronian ones, notably marked by the presence of large isosceles triangles and backed points with retouched base, occasionally with inverse retouch (cf. Fontfaurès) and, possibly, favoured by the absence of continuous natural barriers such as the Alpine ridge.

This variability since the earliest Sauveterrian phases introduces the problem of the origin of the Sauveterrian. If for the Venetian area the direct connection to Late Epigravettian assemblages can be considered a matter of fact (Guerreschi, 1984a; Cusinato et al., 2005), for the Emilian region this can only be presumed due to the lack of Late Epigravettian sites. By the way a continuity between Late Epigravettian and early Sauveterrian assemblages was also observed in Northern Tuscany, namely the Serchio valley, in the site of Isola Santa (Kozlowski et al., 2003). In southern France the modality of this transition is less clear, in particular, in relation to the presence of two different contemporaneous cultural groups, the Laborian/Epilaborian and the Late Epigravettian. Without any pretense to solve the problem, the present work allows advancing a few considerations and hypotheses. First of all an Italian origin of the French Sauveterrian can be excluded in light of the numerous above mentioned differences between the two areas. By exclusion a transition modality similar to the Italian one can be presumed. The problem would be identifying if it was the Epilaborian or the Epigravettian to be involved (but are they really that different? Actually with the exception of the Malaurie points their respective features and technological systems do not seem that dissimilar). Considering the presence in the Epilaborian assemblages (Langlais et al., 2015) of backed points with natural

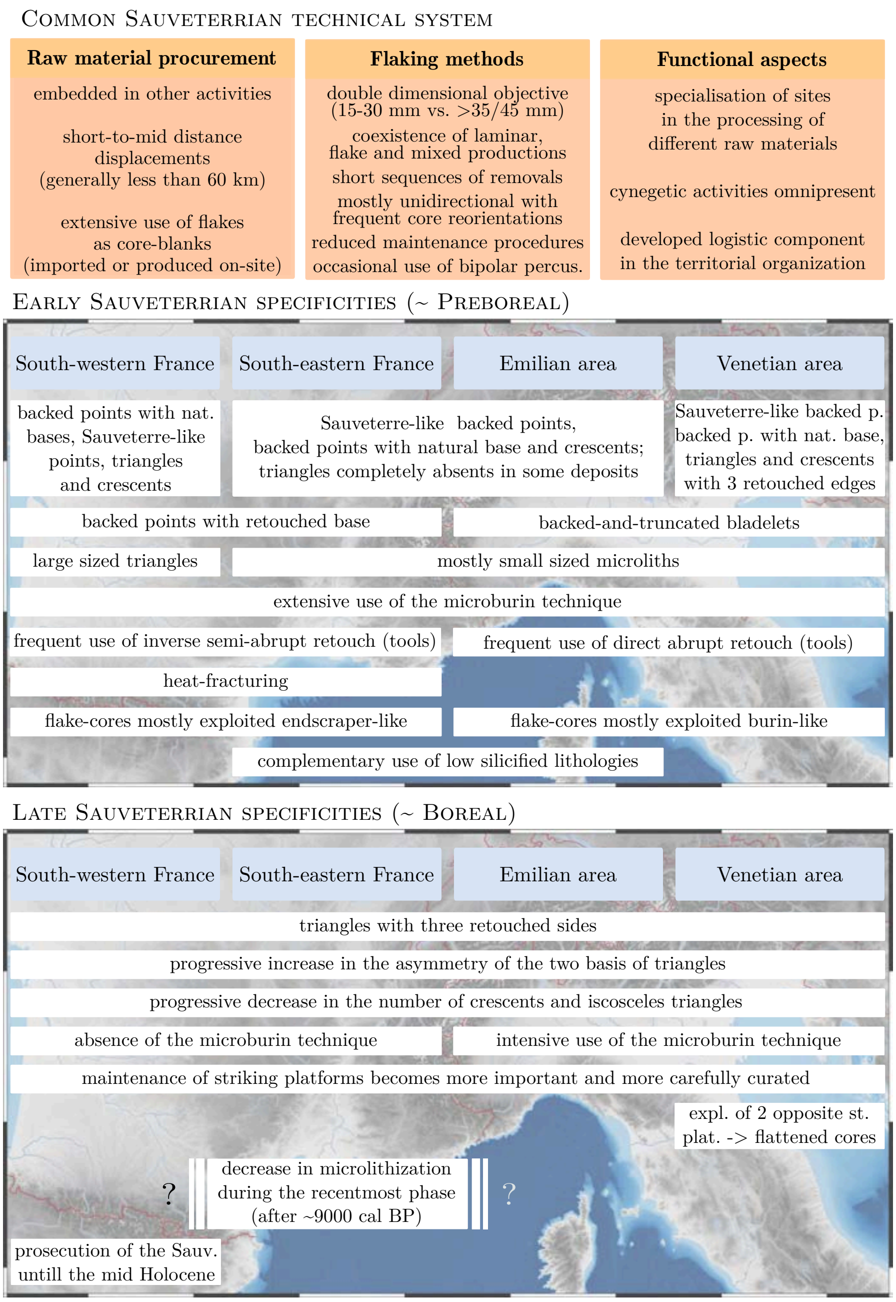

Figure 16.1: Common features of the Sauveterrian technical system and main regional and diachronic specificities in south-western France and north-eastern Italy.

base that appear rather similar to those that characterize the Sauveterrian levels of Rouffignac and level 6 of Fontfaurès it seems fair to advance the hypothesis of a possible relationship between the two. Hopefully the most recent developments of the study on these lithic assemblages will allow to get a better picture on the transition between the Upper Palaeolithic and the Mesolithic in this region.

For the recent part of the Sauveterrian (starting from around 9800 cal BP) the hypothesis of an homogenisation of lithic assemblages was proposed (Valdeyron, 1994, 2008a), marked by the development of Montclus triangles and corresponding to the "explosive phase" of Kozlowski's model (1976). This homogeneity is, at a closer analysis, only apparent. Both regions share a same trend: i.e. the progressive tendency of triangles to present a higher asymmetry of the two basis, thus becoming more elongated. Nonetheless a most significative divergence in the modality in which microliths were produced can be highlighted. In the Italian assemblages the microburin technique continues to be massively adopted during the entire Sauveterrian time span. On the other hand in southern France, Montclus triangles, as well as the other microliths, were manufactured by exploiting the entire length of small lamellar blanks and the microburin technique is abandoned (Barbaza and Valdeyron, 1991; Guilbert, 2003; Chesnaux, 2014a; Angelin et al., 2016). This divergence in the technical processes for the production of microlithic armatures seems most significant in highlighting the presence of, at least, two main areas of influence: a Western Sauveterrian region ("Sauveterrien") and an Eastern Sauveterrian one ("Sauveterriano").

16.2 The Mesolithic of Western Europe: a prehistoric liquid society?

Following the reasoning that led us to surmise the existence of two main distinct Sauveterrian regions, it seems now natural to question the homogeneity of these two areas. Without entering the very details of this matter, that goes far beyond the limits of this work, a few general considerations seem to point in a specific direction. As regards the northern Italian territory, the existence of, at least, two main sub-regions delimited by the river Po was recently proposed (Fontana and Visentin, 2016). The presence of regional aspects along the entire peninsula and on the islands as it was already observed by various authors (cf. Kozlowski et al., 2003; Lo Vetro and Martini, 2016) could also be interpreted in this perspective. As regards southern France, the occurrence of "ambiguous" features highlighted, for example, in the south-eastern area allows supposing the existence of a similar trend. Just to mention a couple of examples, the marked microlithization highlighted for the Proveneçal area allowed Guilbert (2003) to propose a possible Italian influence while the presence of crescents dominated sites (former Montadian) in the earliest phases finds interesting comparisons in the Emilian assemblages. The existence of similar subregions in southern France was highlighted also through the study of osseous industries (Marquebielle, 2014), thus confirming the pattern proposed for lithic assemblages.

And what about the previously recalled homogeneity of lithic technical systems? In this regard it should be considered that such a "technical package" does not necessarily reflects a specificity of the Sauveterrian technology but could encompass most of western European Early Mesolithic complexes. In this scenario the (former?) dichotomy highlighted between the north-western part of the continent, marked by the presence of numerous, small and often embricated cultural groups (cf. Blanchet et al., 2006; Crombé et al., 2008; Marchand, 2008; Vermeersch, 2008; Michel, 2011;

Ducrocq, 2013; Séara and Roncin, 2013; Souffi et al., 2013; Verjux et al., 2013; Séara, 2014) and the homogenous southern one should probably be reconsidered, at least admitting the existence of multiple hierarchical levels of analysis.

By summarizing and interpreting the data concerning the current Sauveterrian evidence (*sensu lato*), it seems that the last hunter-gatherers-collector groups responded to the demographic instability, presumably marked by a progressive increasing trend (Stiner et al., 1999, 2000; Riede, 2009; Riede et al., 2009) and related to the important environmental changes that characterized the Late- and Postglacial periods, not only by expanding dietary breadth (Binford, 1968; Flannery, 1969) but also by reducing the extension of territories and changing mobility patterns, a process documented in all south-western Europe since the the Late Palaeolithic (Langlais et al., 2012; Naudinot et al., 2014; Tomasso, 2015; Pétillon et al., 2016; Bertola et al., in press). Sauveterrian technology reflects these changes and was fundamental in allowing the development of a complex settlement structure (cf. Fontana and Visentin, 2016) characterized by a mobility system based on relatively short distances with respect to the Upper Palaeolithic one and with a strong logistic component. It is quite likely that such a change brought about also important social transformations (Newell and Constandse-Westermann, 2015) although, for the moment, little is known in this concern. As a matter of fact I think that it could be informative to try and re-assess part of Rozoy's model (1978) by mapping the local variability that seems to be reflected by the material culture in order to evaluate its pertinence as well as to test the possible social and ethnic implication. Besides the presence of these regional features, when looking at the big picture, the impression is that of frequent contacts and of a rapid share of technical knowledge among neighbouring groups, possibly favoured by the existence of shared territories, giving the Sauveterrian (or the Mesolithic of western Europe?) a homogenous general aspect that could be described as that of a prehistoric liquid society, by transposing a term used by Z. Bauman (2000) to describe the metaphorical nomadism of modern society.

Appendix A

Radiocarbon evidence

Table A.1: Available radiocarbon datings for south-western France

Site – Layer	Lab. ID	Material	14C age	Calib. age BP	Attribution	Bibliography
Abeurador, sect. Entrée – C5-3	AA-13083	Bone	9755±110	11596-10734	Sauveterrian	Vaquer and Ruas, 2009
Abeurador, sect. Central – 5	MC-2144	n.a.	8740±90	10148-9541	Sauveterrian	Vaquer and Ruas, 2009
Abeurador, sect. Entrée – C6	AA-13084	Bone	9845±115	11760-10800	Sauveterrian	Vaquer and Ruas, 2009
Abri des Fées – B4 sommet	Ly-4706	n.a.	7535±110	8581-8060	Sauveterrian	Roussot-Larroque, 2009
Abri des Fées – B4	Ly-4707	n.a.	8850±270	10673-9307	Sauveterrian	Roussot-Larroque, 2009
Abri des Fées – B4	Ly-4534	n.a.	9490±240	11599-10193	Sauveterrian	Roussot-Larroque, 2009
Abri du Moulin – 3c	Ly-5273	n.a.	8625±80	9887-9479	Sauveterrian	Valdeyron, 1994
Balma Margineda – C5	Ly-3893	n.a.	9790±160	11800-10698	Sauveterrian	Philibert, 2002
Balma Margineda – C6sup	Ly-2842	n.a.	9250±160	11085-9956	Sauveterrian	Philibert, 2002
Baraquettes 1	Beta-108631	n.a.	8700±50	9886-9543	Sauveterrian	Valdeyron et al., 2008
Baraquettes 2	n.a.	n.a.	8250±50	9409-9033	Sauveterrian	Michel, 2011
Baraquettes 4 – C5	n.a.	n.a.	8190±90	9443-8815	Sauveterrian	Michel, 2011
Baraquettes 4 – C5	n.a.	n.a.	8750±150	10198-9522	Sauveterrian	Michel, 2011
Baraquettes 4 – C5a	n.a.	n.a.	8740±100	10152-9539	Sauveterrian	Michel, 2011
Baraquettes 4 – C5a	Gif-10005	n.a.	8750±80	10146-9545	Sauveterrian	Valdeyron et al., 2008
Baraquettes 4 – C5a	Ly-7004	n.a.	9040±80	10409-9914	Sauveterrian	Valdeyron et al., 2008
Baraquettes 4 – C5c	n.a.	n.a.	9065±75	10484-9931	Sauveterrian	Michel, 2011
Bourrouilla – O16	Beta-307296	Charcoal	7410±40	8341-8170	Sauveterrian	Dachary et al., 2013
Bourrouilla – O16	Beta-307295	Charcoal	7650±40	8539-8387	Sauveterrian	Dachary et al., 2013
Buholoup – 3c	Ly-1090	Charcoal	7952±62	8998-8629	Late Mesolithic	Briois and Vaquer, 2009
Buholoup – 4	Ly-6114	Charcoal	7645±80	8596-8327	Undet.	Briois and Vaquer, 2009
Buholoup – 5	Ly-5641	Charcoal	8020±70	9086-8639	Sauveterrian	Briois and Vaquer, 2009
Buholoup – 6a	Ly-5642	Charcoal	8350±70	9495-9137	Sauveterrian	Briois and Vaquer, 2009
Buholoup – 6c	Ly-6113	Charcoal	8425±105	9583-9124	Sauveterrian	Briois and Vaquer, 2009
Buholoup – 6c	Ly-1091	Charcoal	10131±78	12061-11393	Sauveterrian	Briois and Vaquer, 2009
Chez Jugie - 3b base	Ly-1651	n.a.	7650±510	9782-7516	Sauveterrian	Roussot-Larroque, 2009
Chez Jugie - 3b base	Ly-1331	n.a.	8040±260	9524-8400	Sauveterrian	Roussot-Larroque, 2009
Chez Jugie - 3b base	Ly-1652	n.a.	8080±280	9605-8360	Sauveterrian	Roussot-Larroque, 2009

Continued on next page

Table A.1 – continued from previous page

Site – Layer	Lab. ID	Material	14C age	Calib. age BP	Attribution	Bibliography
Cuzoul de Gramat – HA2, F1	Ly-14204	n.a.	6200±45	7247-6988	Late Mesolithic	Valdeyron et al., 2014
Cuzoul de Gramat – HA2, F2b	Ly-14459	n.a.	6760±60	7700-7507	Late Mesolithic	Valdeyron et al., 2014
Cuzoul de Gramat – HA2, F3	Ly-14205	n.a.	6490±40	7476-7316	Late Mesolithic	Valdeyron et al., 2014
Cuzoul de Gramat – SG 5220	Ly-14458	n.a.	6815±40	7712-7582	Late Mesolithic	Valdeyron et al., 2014
Escabasses – 5	Ly-10938	n.a.	7135±60	8152-7835	Late Mesolithic	Valdeyron et al., 2008
Escabasses – 6sommet	Ly-10937	n.a.	8055±60	9129-8662	Sauveterrian	Valdeyron et al., 2008
Escabasses – 6milieu	Ly-12238	n.a.	8275±60	9440-9035	Sauveterrian	Valdeyron et al., 2008
Escabasses – 6base	Ly-12240	n.a.	8310±55	9460-9136	Sauveterrian	Valdeyron et al., 2008
Fontfaurès – 5b	Ly-4448	n.a.	9140±160	10740-9780	Sauveterrian	Barbaza et al., 1991
Fontfaurès – 6	Ly-4449	n.a.	9650±130	11270-10589	Sauveterrian	Barbaza et al., 1991
Grotte du Sanglier – 5b	Ly-6510	n.a.	7557±104	8577-8173	Sauveterrian	Séronie-Vivien, 2001
Grotte du Sanglier – 6	Ly-5687	n.a.	7753±235	9256-8058	Sauveterrian	Séronie-Vivien, 2001
Grotte du Sanglier – 6	Ly-7793	n.a.	8065±80	9247-8649	Sauveterrian	Séronie-Vivien, 2001
Grotte du Sanglier – 6	Ly-7792	n.a.	8075±75	9254-8660	Sauveterrian	Séronie-Vivien, 2001
Grotte du Sanglier – 6 base	Ly-6162	n.a.	7943±76	8999-8600	Sauveterrian	Séronie-Vivien, 2001
La Doue	Ly-2834	n.a.	8880±160	10368-9539	Sauveterrian	Martin and Le Gall, 1987
La Doue – 2a	Ly-2233	n.a.	8750±150	10198-9522	Sauveterrian	Martin and Le Gall, 1987
La Doue – 2a	Ly-2821	n.a.	8860±210	10490-9491	Sauveterrian	Martin and Le Gall, 1987
La Doue – 2b	Ly-2820	n.a.	8980±210	10645-9541	Sauveterrian	Martin and Le Gall, 1987
La Doue – 2b	Ly-2819	n.a.	9260±200	11146-9921	Sauveterrian	Martin and Le Gall, 1987
La Pierre Saint Louis – 5b	n.a.	n.a.	8420±110	9584-9091	Sauveterrian	Roussot-Larroque, 2009
La Poujade – 10B/C	MC-1240	n.a.	8910±145	10366-9550	Sauveterrian	Valdeyron, 1994
La Poujade – 10C	Gif-3418	n.a.	8710±190	10243-9325	Sauveterrian	Valdeyron, 1994
Lède du Gurp	Beta-118447	n.a.	9070±70	10484-9942	Sauveterrian	Roussot-Larroque, 2009
Lède du Gurp – 9	Ly-6045	n.a.	7360±85	8358-8010	Neolithic	Roussot-Larroque, 2009
Lède du Gurp – 10	Ly-6046	n.a.	7350±130	8399-7949	Sauveterrian	Roussot-Larroque, 2009
Lède du Gurp – 11a	Ly-5322	n.a.	9200±70	10552-10234	Sauveterrian	Roussot-Larroque, 2009
Lède du Gurp – 11b	Ly-5321	n.a.	9180±90	10570-10204	Sauveterrian	Roussot-Larroque, 2009
Lède du Gurp – 11c	Ly-5325	n.a.	8760±100	10154-9546	Sauveterrian	Roussot-Larroque, 2009
Lède du Gurp – 11d	Ly-6048	n.a.	8360±60	9516-9144	Sauveterrian	Roussot-Larroque, 2009

Continued on next page

Table A.1 – continued from previous page

Site – Layer	Lab. ID	Material	14C age	Calib. age BP	Attribution	Bibliography
Les Fieux	Gif 4281	n.a.	9060±190	10694-9611	Sauveterrian	Valdeyron et al., 2008
Les Fieux – D	Ly-10805	n.a.	8075±90	9262-8649	Sauveterrian	Valdeyron et al., 2008
Les Fieux – D	Ly-1766	n.a.	8900±70	10209-9744	Sauveterrian	Valdeyron et al., 2008
Les Fieux – D	Ly-1763	n.a.	9080±70	10491-9953	Sauveterrian	Valdeyron et al., 2008
Les Fieux – D	Ly-1765	n.a.	9220±70	10561-10243	Sauveterrian	Valdeyron et al., 2008
Les Fieux – D	Ly-1767	n.a.	9260±70	10646-10248	Sauveterrian	Valdeyron et al., 2008
Les Fieux – D3	Gif 1807	n.a.	9450±190	11200-10258	Sauveterrian	Valdeyron et al., 2008
Les Usclades – 4b	Gif-8744	Charcoal	8220±70	9404-9015	Sauveterrian	Valdeyron, 1994
Peyrazet – 2b	Ly9062/SacA28329	Bone	9235±45	10520-10255	Laborian	Langlais et al., 2015
Peyrazet – 2b	Ly-7828/SacA22775	Bone	9780±45	11260-11140	Laborian	Langlais et al., 2015
Pont d'Ambon – 2	Gif-3740	n.a.	9640±120	11249-10607	Laborian	Langlais et al., 2015
Roc Allan	Ly-4545	Charcoal	8160±90	9423-8781	Sauveterrian	Valdeyron, 1994
Roc de Dourgne – 10	MC-1108	n.a.	8620±120	10146-9421	Sauveterrian	Valdeyron, 1994
Rouffignac – 3	Gro-2889	Charcoal	7800±50	8716-8445	Late Mesolithic	Barrière, 1973
Rouffignac – 4a	Gro-2913	Charcoal	8370±100	9538-9094	Sauveterrian	Barrière, 1973
Rouffignac – 4b	Gro-2895	Charcoal	8590±95	9889-9433	Sauveterrian	Barrière, 1973
Rouffignac – 4c	Gro-2880	Charcoal	8995±105	10400-9744	Sauveterrian	Barrière, 1973
Rouffignac – 5a	GrN-5513	Charcoal	8750±75	10136-9545	Sauveterrian	Barrière, 1973
Rouffignac – 5b	GrN-5514	Charcoal	9150±90	10560-10185	Sauveterrian	Barrière, 1973
Salzets	Gif-443	n.a.	8770±200	10374-9425	Sauveterrian	Valdeyron, 1994

Table A.2: Available radiocarbon datings for south-eastern France

Site – Layer	Lab. ID	Material	14C age	Calib. age BP	Attribution	Bibliography
Abri Martin – 2-3	LTL-801aA	n.a.	10069±80	11979-11294	Late Epigravettian	Tomasso et al., 2014
Abri Martin – 2-4	LTL-8015A	n.a.	9696±75	11240-10781	Late Epigravettian	Tomasso et al., 2014
Baume d'Oullins	MC-2085	n.a.	9600±160	11325-10438	Sauveterrian	Valdeyron, 1994
Baume de Montclus - 15	Beta-255115	Bone	7770±50	8631-8430	Castelnovian	Perrin and Defranould, 2016
Baume de Montclus – 16	Ly-542	Bone	7540±160	8697-7999	Castelnovian	Perrin and Defranould, 2016
Baume de Montclus – 16	Beta-253156	Bone	7670±50	8554-8385	Castelnovian	Perrin and Defranould, 2016
Baume de Montclus – 18B	Beta-255116	Bone	7720±50	8590-8416	Sauveterrian	Perrin and Defranould, 2016
Baume de Montclus – 21F	LY-306	Bone	7780±250	9301-8056	Sauveterrian	Perrin and Defranould, 2016
Baume de Montclus – 21F	LY-305	Bone	7890±170	9243-8385	Sauveterrian	Perrin and Defranould, 2016
Baume de Montclus – 22	LY-308	n.a.	7750±340	9452-7966	Sauveterrian	Perrin and Defranould, 2016
Baume de Montclus – 22	LY-307	Charcoal	7770±410	9596-7790	Sauveterrian	Perrin and Defranould, 2016
Baume de Montclus – 22	KN-58	Charcoal	8130±240	9540-8455	Sauveterrian	Perrin and Defranould, 2016
Baume de Montclus – 23	MC-730	Charcoal	7950±100	9076-8545	Sauveterrian	Perrin and Defranould, 2016
Baume Fontbrégua – 54	Gif-2992	n.a.	8400±110	9550-9090	Sauveterrian	Valdeyron, 1994
Baume Fontbrégua – 61	Gif-2993	n.a.	9570±120	11204-10584	Sauveterrian	Valdeyron, 1994
Couffin I	Ly-3648	n.a.	7810±140	9006-8385	Sauveterrian	Valdeyron, 1994
Couffin I	Ly-2106	n.a.	8200±140	9491-8729	Sauveterrian	Valdeyron, 1994
Gramari – 2b	Gif-4890	n.a.	7800±140	9003-8379	Sauveterrian	Valdeyron, 1994
Gramari – 2b	Gif-754	n.a.	9340±220	11228-9949	Sauveterrian	Valdeyron, 1994
Gramari – 3a1	Gif-262	n.a.	3420±200	4247-3183	Sauveterrian	Valdeyron, 1994
Gramari – 3a1	Gif-752	n.a.	7740±190	9079-8175	Sauveterrian	Valdeyron, 1994
Gramari – 3b1	Gif-263	n.a.	5090±300	6530-5055	Sauveterrian	Valdeyron, 1994
Gramari – 3b1	Gif-753	n.a.	8000±190	9402-8446	Sauveterrian	Valdeyron, 1994
Gramari – 3b2	K.N.-387	n.a.	8830±65	10175-9675	Sauveterrian	Valdeyron, 1994
Gramari – 5	K.N.-388	n.a.	8730±55	9902-9550	Sauveterrian	Valdeyron, 1994
Gramari – 5	K.N.-389	n.a.	9110±150	10685-9783	Sauveterrian	Valdeyron, 1994
Gramari – 5	Gif-755	n.a.	10070±230	12543-11095	Sauveterrian	Valdeyron, 1994
Gramari – 7	K.N.-390	n.a.	9310±60	10674-10295	Sauveterrian	Valdeyron, 1994

Continued on next page

Table A.2 – continued from previous page

Site – Layer	Lab. ID	Material	14C age	Calib. age BP	Attribution	Bibliography
Grotte Jean Pierre I – 5a	Ly-425	n.a.	9050±260	11068-9534	Sauveterrian	Valdeyron, 1994
La Grand Rivoire – d34	Beta-282248	Bone	7790±40	8637-8455	Castelnovian	Angelin et al., 2016
La Grand Rivoire – C	Ly-5433	Bone	8280±80	9463-9032	Sauveterrian	Angelin et al., 2016
La Grand Rivoire – C	GrA25065	Bone	8640±50	9732-9527	Sauveterrian	Angelin et al., 2016
La Grand Rivoire – D	Ly-5434	Bone	8740±110	10154-9538	Sauveterrian	Angelin et al., 2016
La Grand Rivoire – D	GrA25064	Bone	9160±50	10487-10230	Sauveterrian	Angelin et al., 2016
La Vielle Eglise – 6a	Ly-1936	n.a.	8170±160	9476-8649	Sauveterrian	Valdeyron, 1994
La Vielle Eglise – 7a	CGR-410	n.a.	9485±325	11951-9906	Azilian	Valdeyron, 1994
La Vielle Eglise – 7a	Ly-2619	n.a.	9820±200	12004-10671	Azilian	Valdeyron, 1994
Les Agnels	n.a.	Charcoal	8050±130	9395-8589	Sauveterrian	Guilbert, 2003
Les Agnels	Gif-10239	Charcoal	8250±115	9501-8990	Sauveterrian	Guilbert, 2003
Mourre du Sève	Lyon-149-OxA	Charcoal	7640±65	8561-8347	Castelnovian	Marchand and Perrin, 2017
Mourre du Sève	Lyon-149-OxA	Charcoal	7730±60	8606-8406	Castelnovian	Marchand and Perrin, 2017
Pas de l'Échelle – E1	Ly-4686	Bone	7630±50	8541-8370	Castelnovian	Bintz, 1995
Pas de l'Échelle – E3	Ly-6794	Bone	8270±45	9427-9095	Sauveterrian	Bintz, 1995
Pas de l'Échelle – E3b	Ly-7095	Bone	8050±95	9252-8633	Sauveterrian	Bintz, 1995
Pas de l'Échelle – E4	Ly-4598	Bone	8695±40	9772-9544	Sauveterrian	Bintz, 1995
Saint-Mitre – 4a	MC-266	n.a.	7950±150	9248-8432	Sauveterrian	Valdeyron, 1994
Sansonnet	Ly-500	Charcoal	9995±95	11937-11230	Sauveterrian	Guilbert, 2003

Table A.3: Available radiocarbon datings for the central-eastern Alps and pre-Alps

Site – Layer	Lab. ID	Material	14C age	Calib. age BP	Attribution	Bibliography
Casera Lissandri 17	Poz-9919	Charcoal	9410±50	10757-10511	Sauveterrian	Peresani et al., 2009
Cividate Camuno, Via Palazzo - 282	GX-18843	n.a.	8820±112	10184-9561	Sauveterrian	Martini et al., 2016a
Colbricon – S1	R-895	Charcoal	9370±130	11083-10249	Sauveterrian	Broglio and Improta, 1995
Colbricon – S3	UtC-13426	Charcoal	8760±60	10124-9550	Sauveterrian	Grimaldi, 2006
Colbricon – S3	UtC-13425	Charcoal	8833±70	10180-9664	Sauveterrian	Grimaldi, 2006
Colbricon – S7	UtC-13420	Charcoal	8200±50	9300-9015	Sauveterrian	Grimaldi, 2006
Colbricon – S8	UtC-13423	Charcoal	9550±60	11133-10691	Sauveterrian	Grimaldi, 2006
Colbricon – S8	UtC-13424	Charcoal	9600±60	11170-10745	Sauveterrian	Grimaldi, 2006
Colbricon – S9	UtC-13419	Charcoal	9730±60	11252-10801	Sauveterrian	Grimaldi, 2006
Gaban – FA	KIA-10366	Charcoal	7725±49	8590-8420	Castelnovian	Kozlowski and Dalmeri, 2002
Gaban – FA	KIA-10367	Charcoal	7902±55	8979-8593	Castelnovian	Kozlowski and Dalmeri, 2002
Gaban – FA	KIA-10364	Charcoal	7971±42	8996-8650	Castelnovian	Kozlowski and Dalmeri, 2002
Gaban – FA	KIA-10365	Charcoal	8323±63	9471-9135	Castelnovian	Kozlowski and Dalmeri, 2002
Gaban – FB	KIA-10368	Charcoal	8193±66	9399-9007	Sauveterrian	Kozlowski and Dalmeri, 2002
Gaban – FC	KIA-10369	Charcoal	8509±44	9545-9463	Sauveterrian	Kozlowski and Dalmeri, 2002
Gaban – FC	KIA-10370	Charcoal	8847±57	10170-9705	Sauveterrian	Kozlowski and Dalmeri, 2002
Galgenbühel – ph.5	LTL2013A	n.a.	8454±46	9537-9408	Sauveterrian	Wierer et al., 2016
Galgenbühel – ph.5	ETH-22091	n.a.	8560±65	9681-9460	Sauveterrian	Wierer et al., 2016
Galgenbühel – ph.4	ETH-22089	n.a.	8190±65	9397-9006	Sauveterrian	Wierer et al., 2016
Galgenbühel – ph.4	ETH-27176	n.a.	8580±65	9695-9469	Sauveterrian	Wierer et al., 2016
Galgenbühel – ph.4	ETH-27177	n.a.	8760±70	10135-9549	Sauveterrian	Wierer et al., 2016
Galgenbühel – ph.3	ETH-27175	n.a.	8760±70	10135-9549	Sauveterrian	Wierer et al., 2016
Galgenbühel – ph.3	LTL12014A	n.a.	8908±45	10200-9888	Sauveterrian	Wierer et al., 2016
Galgenbühel – ph.2	ETH-27174	n.a.	8825±70	10175-9633	Sauveterrian	Wierer et al., 2016
Galgenbühel – ph.1	LTL12015A	n.a.	9264±49	10571-10279	Sauveterrian	Wierer et al., 2016
Galgenbühel – ph.1	ETH-27173	n.a.	9265±70	10648-10250	Sauveterrian	Wierer et al., 2016
La Cogola - SU16	UtC-9284	Charcoal	9430±60	11066-10504	Sauveterrian	Dalmeri, 2005

Continued on next page

Table A.3 – continued from previous page

Site – Layer	Lab. ID	Material	14C age	Calib. age BP	Attribution	Bibliography
La Cogola - SU18	UtC-9285	Charcoal	9820±60	11391-11142	Late Epigravettian	Dalmeri, 2005
Laghetti del Crestoso – F10	Beta-35421	Charcoal	7850±80	8980-8459	Castelnovian	Franco, 2011
Laghetti del Crestoso – F9	GrN-21889	Charcoal	7870±50	8975-8547	Castelnovian	Franco, 2011
Laghetto delle Regole 3	KIA-20343	n.a.	9737±42	11241-10910	Sauveterrian	Dalmeri et al., 2005b
Lago delle Buse 2 – 3-6	Gd-6160	Charcoal	8220±110	9485-8798	Sauveterrian	Dalmeri and Lanzinger, 1994
Lago delle Buse 3 – 3	Kl-3636.02	Charcoal	9020±190	10588-9559	Sauveterrian	Dalmeri and Lanzinger, 1994
Lago delle Buse 3 – 4	Kl-3636.01	Charcoal	8540±180	10154-9126	Sauveterrian	Dalmeri and Lanzinger, 1994
Mezzocorona Borgonuovo – 148	KIA-12446	Bone	7797±43	8684-8450	Sauveterrian	Dalmeri et al., 2002
Mondeval de Sora, VF1-I – 8	GX-21788	Charcoal	9185±240	11106-9700	Sauveterrian	Fontana et al., 2009c
Mondeval de Sora, VF1-III – 10	GX-21797	Charcoal	8445±50	9537-9320	Sauveterrian	Valletta et al., 2016
Mondeval de Sora, VF1-III – 32	GX-27748	Charcoal	9160±90	10562-10193	Sauveterrian	Valletta et al., 2016
Palughetto	GX-21231	Charcoal	9495±50	11077-10587	Sauveterrian	Peresani et al., 2011
Plan de Frea IV – 3BII	R-2714	Charcoal	8688±99	10135-9498	Sauveterrian	Alessio et al., 1996
Plan de Frea IV – 3BIII	R-2565	Charcoal	9558±90	11179-10604	Sauveterrian	Alessio et al., 1996
Plan de Frea IV – 3BIV	R-2715	Charcoal	9663±392	12521-9966	Sauveterrian	Alessio et al., 1996
Plan de Frea IV – 3BIV	R-2713	Charcoal	9883±68	11605-11193	Sauveterrian	Alessio et al., 1996
Plan de Frea IV – 5	R-2566	Charcoal	9377±198	11196-10220	Sauveterrian	Alessio et al., 1996
Pradestel - H-H2	R-1149	Charcoal	8200±50	9300-9015	Sauveterrian	Broglio and Improta, 1995
Pradestel - L1	R-1150	Charcoal	8240±200	9554-8605	Sauveterrian	Broglio and Improta, 1995
Pradestel - L7-L8	R-1151	Charcoal	9320±50	10684-10301	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AB1-2	R-1137B	Charcoal	7800±80	8971-8413	Castelnovian	Broglio and Improta, 1995
Romagnano Loc III – AB1-2	R-1137	Charcoal	7850±60	8977-8481	Castelnovian	Broglio and Improta, 1995
Romagnano Loc III – AB3	R-1138	Charcoal	8140±80	9399-8779	Reworked	Broglio and Improta, 1995
Romagnano Loc III – AC1	R-1139	Charcoal	8220±80	9414-9013	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AC2	R-1140	Charcoal	8560±70	9688-9443	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AC3	R-1141	Charcoal	8590±90	9887-9435	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AC4	R-1142	Charcoal	8740±90	10148-9541	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AC5-6	R-1143a	Charcoal	9090±90	10512-9932	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AC7	R-1144a	Charcoal	9100±90	10520-9938	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AC8	R-1145	Charcoal	9200±60	10516-10237	Sauveterrian	Broglio and Improta, 1995

Continued on next page

Table A.3 – continued from previous page

Site – Layer	Lab. ID	Material	14C age	Calib. age BP	Attribution	Bibliography
Romagnano Loc III – AC9	R-1145a	Charcoal	9200±60	10516-10237	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AE	R-1146B	Charcoal	9420±60	11065-10496	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AE	R-1146A	Charcoal	9490±80	11107-10563	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AE	R-1146a	Charcoal	9580±250	11709-10240	Sauveterrian	Broglio and Improta, 1995
Romagnano Loc III – AF	R-1147	Charcoal	9830±90	11620-10875	Sauveterrian	Broglio and Improta, 1995
Staller Sattel, STS 4A – 3	LTL4394A	Charcoal	8226±50	9399-9027	Sauveterrian	Kompatscher et al., 2016
Staller Sattel, STS 4A – 10	LTL4395A	Charcoal	8163±50	9263-9008	Sauveterrian	Kompatscher et al., 2016
Staller Sattel, STS 4A – 14	LTL5646A	Charcoal	9137±50	10482-10215	Sauveterrian	Kompatscher et al., 2016
Staller Sattel, STS 4A – 15	LTL5645A	Charcoal	8900±50	10197-9791	Sauveterrian	Kompatscher et al., 2016
Staller Sattel, STS 4A – 17	LTL8444A	Charcoal	8009±70	9075-8633	Sauveterrian	Kompatscher et al., 2016
Staller Sattel, STS 4A – 23	LTL14345A	Charcoal	8070±45	9124-8776	Sauveterrian	Kompatscher et al., 2016
Staller Sattel, STS 4A – 25	LTL14026A	Charcoal	7861±60	8978-8541	Sauveterrian	Kompatscher et al., 2016
Val Maione 2	GrN-20093	Charcoal	9410±80	11071-10413	Sauveterrian	Biagi and Starnini, 2016
Val Maione 2	GrN-20890	Charcoal	9630±100	11221-10705	Sauveterrian	Biagi and Starnini, 2016
Vatte di Zambana – 10	R-490	Charcoal	7860±110	8996-8448	Sauveterrian	Broglio and Improta, 1995
Vatte di Zambana – 10	R-490a	Charcoal	7960±100	9085-8550	Sauveterrian	Broglio and Improta, 1995
Vatte di Zambana – 7	R-489	Charcoal	7810±95	8977-8415	Sauveterrian	Broglio and Improta, 1995
Vatte di Zambana – 7	R-489a	Charcoal	7860±75	8986-8481	Sauveterrian	Broglio and Improta, 1995
Vatte di Zambana – burial	R-491a	Charcoal	7740±150	8999-8218	Sauveterrian	Broglio and Improta, 1995
Vatte di Zambana – burial	KIA-12442	H. bone	7943±46	8985-8639	Sauveterrian	Dalmeri et al., 2002
Vatte di Zambana – burial	R-491	Charcoal	8000±110	9242-8581	Sauveterrian	Broglio and Improta, 1995

Table A.4: Available radiocarbon datings for the northern Apennines and Emilian area

Site – Layer	Lab. ID	Material	14C age	Calib. age BP	Attribution	Bibliography
Bagioletto Alto, IV B22	Ben 2839	Charcoal	8260±60	9429-9033	Sauveterrian	Cremaschi et al., 1984
Collecchio	LTL12390A	Charcoal	9442±60	11068-10513	Sauveterrian	Visentin et al., 2016a
Collecchio	LTL6147A	Hazelnut	9643±70	11200-10763	Sauveterrian	Visentin et al., 2016a
Isola Santa – 4a	R-1525a	Charcoal	7380±90	8370-8020	Sauveterrian	Kozlowski et al., 2003
Isola Santa – 4a	R-1525	Charcoal	7460±130	8518-8010	Sauveterrian	Kozlowski et al., 2003
Isola Santa – 4b	R-1526	Charcoal	8840±120	10200-9561	Sauveterrian	Kozlowski et al., 2003
Isola Santa – 4c	R-1527	Charcoal	8590±90	9887-9435	Sauveterrian	Kozlowski et al., 2003
Isola Santa – 4d	R-1528	Charcoal	8780±110	10159-9551	Sauveterrian	Kozlowski et al., 2003
Isola Santa – 4e	R-1529	Charcoal	9220±90	10650-10225	Sauveterrian	Kozlowski et al., 2003
Lama Lite	Rome-394	Charcoal	6620±80	7659-7340	Castelnovian	Kozlowski et al., 2003
Le Mose, US 507, Locus 7	Poz-13343	Charcoal	8250±50	9409-9033	Sauveterrian	Fontana et al., 2013
Le Mose, US 507, Pl 19S	Poz-13344	Charcoal	9220±50	10514-10248	Sauveterrian	Fontana et al., 2013
Passo della Comunella	Birm-830	Charcoal	6960±130	8016-7578	Castelnovian	Kozlowski et al., 2003
Piazzana – 3A1	Rome-400	Charcoal	7330±85	8339-7983	Castelnovian	Kozlowski et al., 2003
Piazzana – 3D	R-395	Charcoal	8080±90	9270-8650	Sauveterrian	Kozlowski et al., 2003
Piazzana – 3E	R-396	Charcoal	8450±90	9595-9143	Sauveterrian	Kozlowski et al., 2003
Piazzana – 3F	R-397	Charcoal	8890±90	10225-9695	Sauveterrian	Kozlowski et al., 2003
Piazzana – 3G	R-398	Charcoal	8780±90	10154-9555	Sauveterrian	Kozlowski et al., 2003
Piazzana – 3I	R-399	Charcoal	8990±90	10372-9770	Sauveterrian	Kozlowski et al., 2003
Riparo Fredian – 4	AA-10951	Charcoal	9458±91	11105-10444	Sauveterrian	Kozlowski et al., 2003

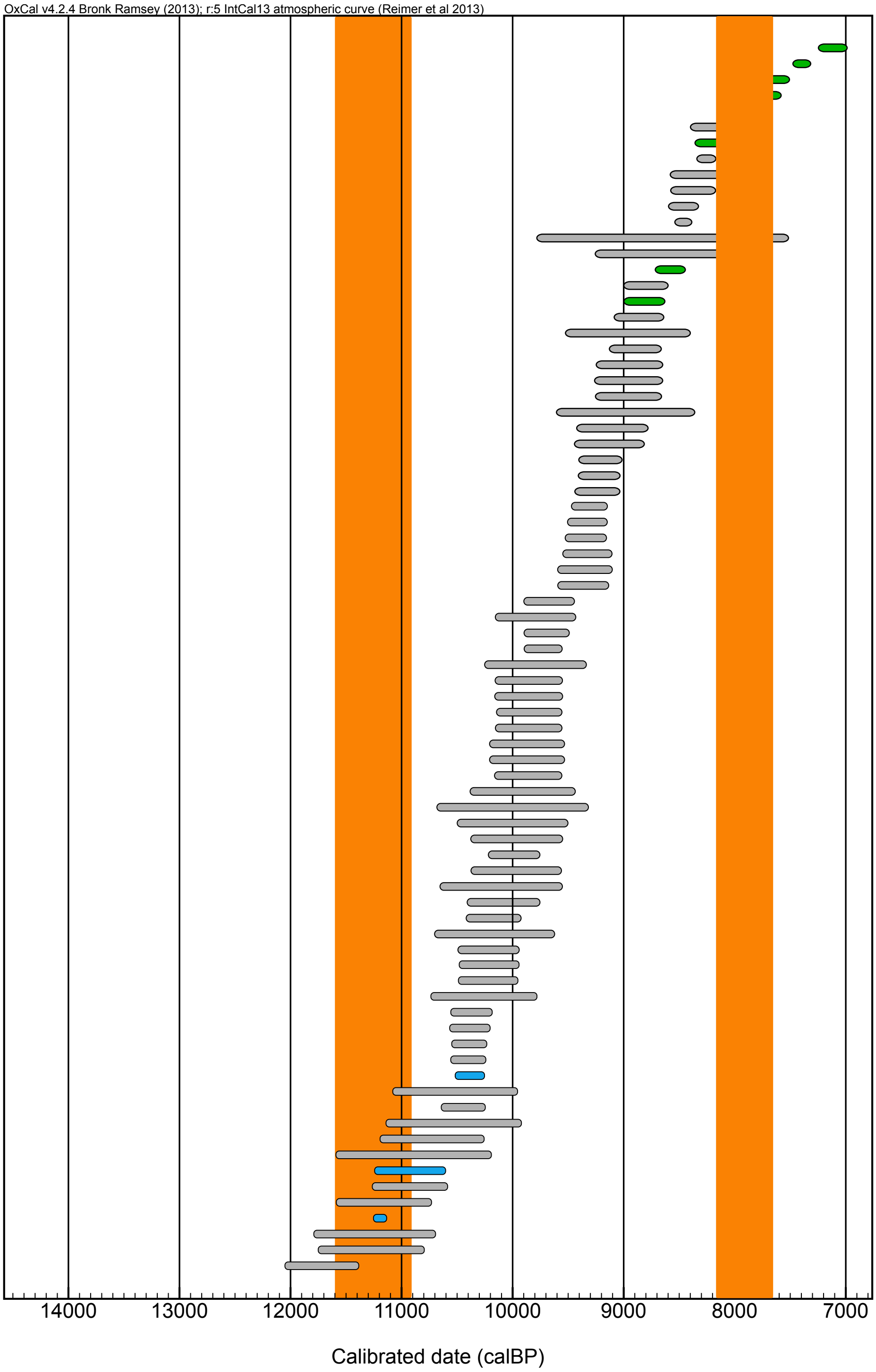

Figure A.1: Plot of all the Sauveterrian radiocarbon datings of south-western France. Blu colour indicates Holocene assemblages attributed to Upper Palaeolithic cultures; green colour indicates the oldest Late Mesolithic datings

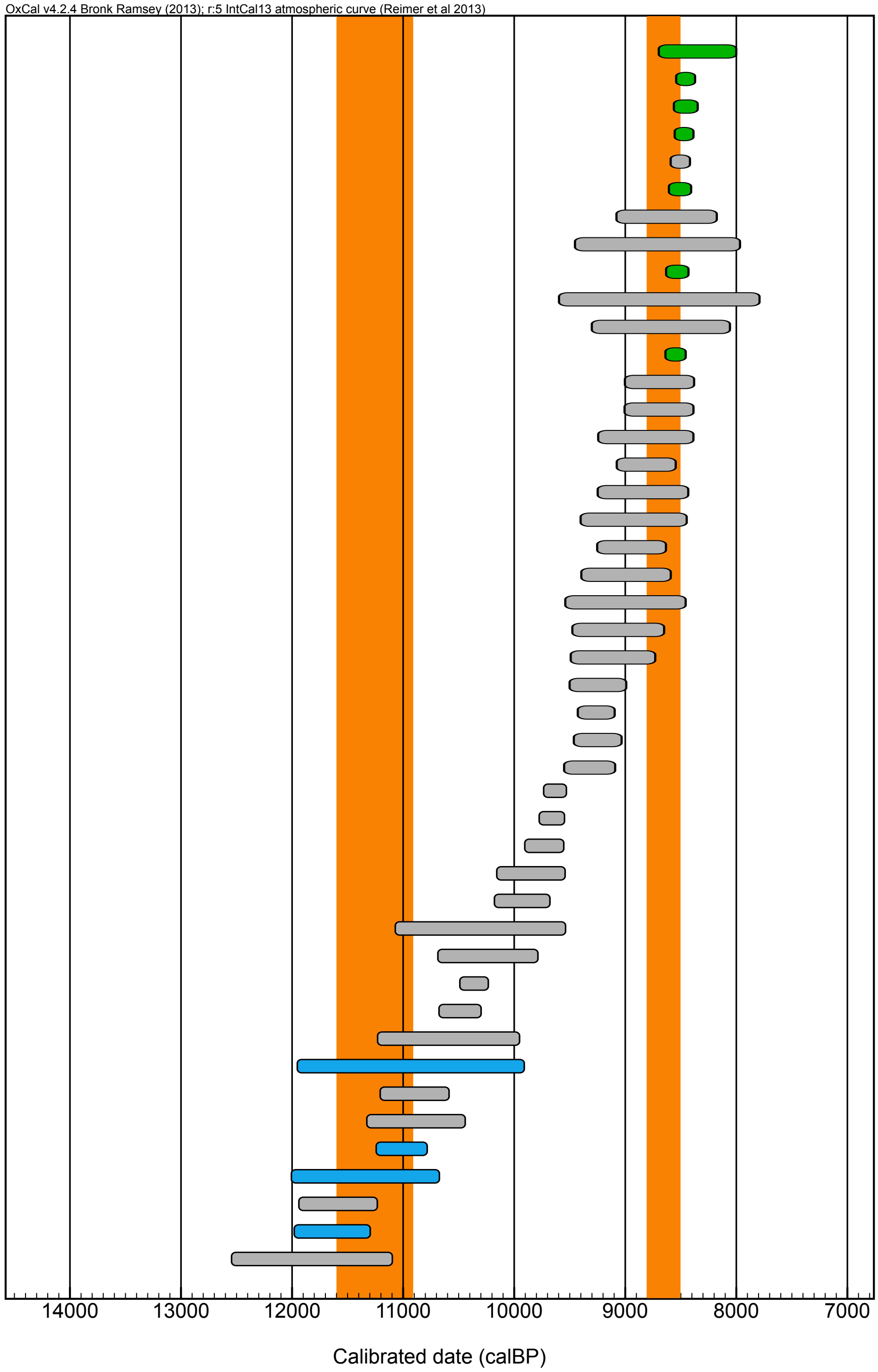

Figure A.2: Plot of all the Sauveterrian radiocarbon datings of south-eastern France. Blu colour indicates Holocene assemblages attributed to Upper Palaeolithic cultures; green colour indicates the oldest Late Mesolithic datings

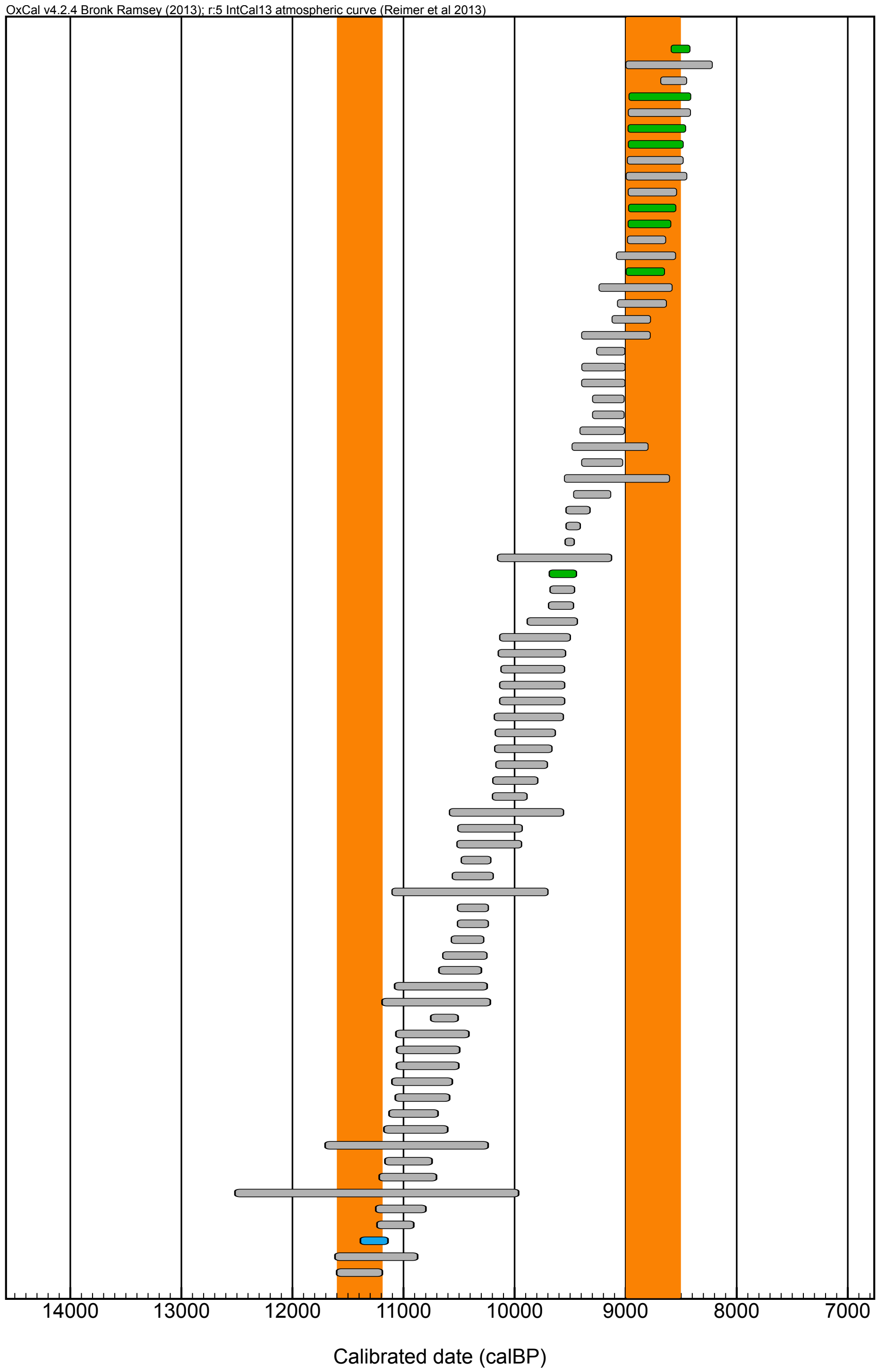

Figure A.3: Plot of all the Sauveterrian radiocarbon datings of the central-eastern Alps and pre-Alps area. Blu colour indicates Holocene assemblages attributed to Upper Palaeolithic cultures; green colour indicates the oldest Late Mesolithic datings

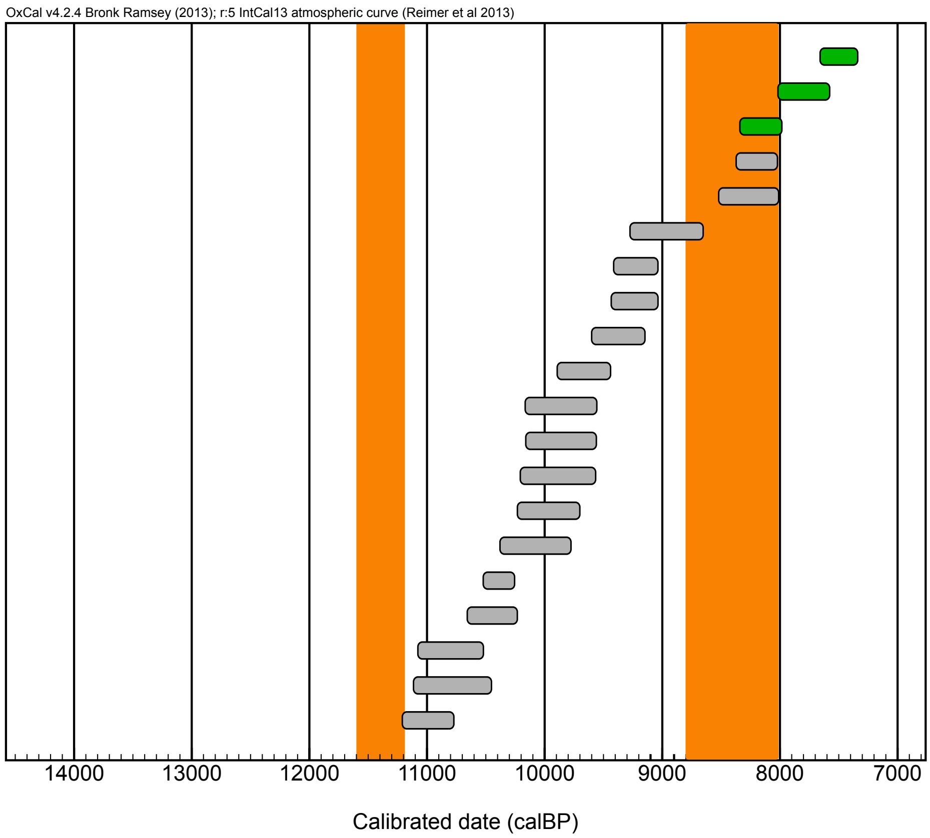

Figure A.4: Plot of all the Sauveterrian radiocarbon datings of the northern Apennines and Emilian area. Green colour indicates the oldest Late Mesolithic datings

Appendix B

Value list and description of the technological interpretation database field

Follows the enumeration and brief description of the list of values adopted during the compilation of the technological interpretation field of the database (cf. Chapter 3). In the presentation of data, occasionally, some of these value could have been grouped or slightly modified in accordance to site specificities and/or population size.

Initialisation blanks:

- opening blade/bladelet - totally cortical laminar blank presumably detached for opening a new striking platform or debitage surface;
- naturally crested blade/bladelet - totally cortical laminar blank exploiting a natural ridge;
- opening flake - totally cortical flake presumably detached for opening a new striking platform or debitage surface;
- crested blade/bladelet;
- unidirectional crested blade\bladelet;
- partially crested blade/bladelet;
- generic cortical flake - different (almost) totally cortical flakes.

Products and by-products:

- blade/bladelet;
- laminar flake;
- flake;
- bladelet/flake - undetermined value used for fragments or intensively modified blanks;

- semi-cortical blade\bladelet;
- naturally backed blade\bladelet - blade detached along the side of the core presenting an almost right angle between the ventral face and one dorsal facet;
- cortical naturally backed blade\bladelet - as the previous, when the lateral surface of the core is cortical;
- on edge blade\bladelet - thick blade with a triangular cross-section;
- semi-cortical on edge blade/bladelet;
- semi-cortical flake;
- naturally backed flake - see naturally backed blade;
- cortical naturally backed flake - see cortical naturally backed blade.

Maintenance blanks:

- neo-crested blade/bladelet;
- partially neo-crested blade/bladelet;
- surface maintenance flake;
- surface maintenance blade;
- surface maintenance blade from opposite striking platform;
- naturally backed surface maintenance bladelet;
- naturally backed surface maintenance flake;
- maintenance flake from opposite striking platform;
- reorientation flake;
- proximal reorientation blade - reorientation blade exploiting the overhang of the previous striking platform as guiding ridge;
- distal reorientation blade - reorientation blade exploiting the distal end of the previous debitage surface;
- reorientation blade - different or undetermined reorientation blades;
- *tablette* - blank detaching the entire striking platform;
- striking platform maintenance flake - blank detaching a portion of the striking platform;
- generic maintenance flake;

Different blanks:

- burin spall;

- retouch flake - flake resulting from the retouch of another blank;
- notch waste - flake resulting from the shaping of a notch;
- bladelet <1cm;
- flake <1cm;
- Undetermined fragments;
- *débris* - fragments fractured in correspondence of diaclases, devoid of proper flaked surfaces.

Bibliography

Accorsi, C., Bandini Mazzanti, M., Forlani, L., Mercuri, A., and Trevisan Grandi, G. (1999). An overview of Holocene forest pollen flora/vegetation of the Emilia Romagna Region – Northern Italy. *Archivio Geobotanico*, 5:3–27.

Aimar, A., Alciati, G., Broglio, A., Castelletti, L., Cattani, L., D'Amico, C., Giacobini, G., Maspero, A., and Peresani, M. (1994). Les Abris Villabruna dans la Vallée du Cismòn. *Preistoria Alpina*, 28(1992):227–254.

Albarello, B. (1988). *Monographie fonctionnaliste. Le microlithique dans le Mésolithique récent et final de l'Agenais/Périgord/Quercy*. Mémoire de doctorat, Université de Paris X - Nanterre.

Alciati, G., Cattani, L., Fontana, F., Gerhardinger, M. E., Guerreschi, A., Milliken, S., Mozzi, P., and Rowley-Conwy, P. (1994). Mondeval de Sora: a high altitude Mesolithic camp-site in the Italian Dolomites. *Preistoria Alpina*, 28(1992):351–366.

Alessio, M., Angelucci, D. E., Broglio, A., and Improta, S. (1996). New data for the chronology of the Mesolithic in the Dolomites. The radiocarbon dates from Plan de Frea (Selva Val Gardena, Italy). *Preistoria Alpina*, 30(1994):145–154.

Amiel, C. and Lelouvier, L.-A., editors (2003). *Gisements post-glaciaires en Bas-Quercy*. AEP/Centre d'Anthropologie et INRAP, Toulouse.

Anderson-Gerfaud, P. (1981). *Contribution méthodologique à l'analyse des microtraces d'utilisation sur les outils préhistoriques*. Thèse de 3ème cycle, Université de Bordeaux.

Angeli, L., Grifoni Cremonesi, R., Negrino, F., Radi, G., Serradimigni, M., and Usala, M. (2011a). Le industrie litiche di Grotta Continenza e Ortucchio-Strada 28. In *Il Fucino e le aree limitrofe nell'antichità. Atti del III Convegno di Archeologia in ricordo di Walter Cianciusi. Castello Orsini, Avezzano, 13-15 novembre 2009*, pages 55–66.

Angeli, L., Liccati, N., Negrino, F., and Radi, G. (2011b). L'industria mesolitica di Ortucchio-Strada 28 (AQ). In *Il Fucino e le aree limitrofe nell'antichità. Atti del III Convegno di Archeologia in ricordo di Walter Cianciusi. Castello Orsini, Avezzano, 13-15 novembre 2009*, pages 92–106.

Angelin, A., Bridault, A., Brochier, J. L., Chaix, L., Chesnaux, L., Marquebielle, B., Martin, L., Nicod, P.-Y., Picavet, R., and Vannieuwenhuyse, D. (2016). The First Mesolithic in the French Alps: New data from La Grande Rivoire rockshelter (Vercors range, Isère, France). *Quaternary International*, 423:193–212.

Angelucci, D., Cremaschi, M., Negrino, F., and Pelfini, M. (1994). Il sito mesolitico di Dosso Gavia - Val di Gavia (Sondrio - Italia): evoluzione ambieritale e popolamento umano durante l' Olocene antico nelle Alpi Centrali. *Preistoria Alpina*, 28(1992):19–32.

Angelucci, D. E., Alessio, M., Bartolomei, G., Cassoli, P. F., Improta, S., Maspero, A., and Tagliacozzo, A. (2001). The Frea IV rockshelter (Selva V al Gardena, BZ). *Preistoria Alpina*, 34(1998):99–109.

Angelucci, D. E., Bartolomei, G., Broglio, A., Cassoli, P. F., Improta, S., Maspero, A., and Tagliacozzo, A. (1999). Plan de Frea, site 4 (Dolomites): mobilité, saisonalité et exploitation du mileiu montagnard durant le Mésolithique. In Thévenin, A., editor, *L'Europe des derniers chasseurs, 5e Colloque international UISPP, 18-23 septembre 1995*, pages 443–448.

Aranguren, B. and Revedin, A. (1998). Il giacimento mesolitico di Perriere Sottano (Ramacca, CT). *Bullettino di Paletnologia Italiana*, 89:31–72.

Arrighi, S., Bazzanella, M., Boschin, F., and Wierer, U. (2016). How to make and use a bone "spatula". An experimental program based on the Mesolithic osseous assemblage of Galgenbühel/Dos de la Forca (Salurn/Salorno, BZ, Italy). *Quaternary International*, 423:143–165.

Astuti, P., Dini, M., Grifoni Cremonesi, R., Kozłowski, S. K., and Tozzi, C. (2005). L'industria mesolitica di Grotta Marisa (Lecce, Puglia) nel quadro delle industrie litiche dell'Italia meridionale. *Rivista di Scienze Preistoriche*, LV:185–208.

Awsiuk, R., Bartolomei, G., Cattani, L., Cavallo, C., Dalmeri, G., D'Errico, F., Giacobini, G., Girod, A., Hercman, H., Jardon-Giner, P., Nisbet, R., Pazdur, M. F., Peresani, M., and Riedel, A. (1994). La Grotta d'Ernesto (Trento): frequentazione umana e paleoambiente. *Preistoria Alpina*, 27(1991):7–160.

Bagolini, B. (1972). Primi risultati delle ricerche sugli insediamenti epipaleolitici del Colbricon (Dolomiti). *Preistoria Alpina*, 8:107–149.

Bagolini, B. and Broglio, A. (1975). Pradestel (Trento). *Preistoria Alpina*, 11:331.

Bagolini, B., Broglio, A., and Lunz, R. (1983). Le Mésolithique des Dolomites. *Preistoria Alpina*, 19:15–36.

Bagolini, B. and Dalmeri, G. (1987). I siti mesolitici del Colbricon (Trentino). Analisi spaziale e fruizione del territorio. *Preistoria Alpina*, 23:7–188.

Bagolini, B., Ferrari, A., Lanzinger, M., and Pasquali, T. (1984). Pian dei Laghetti - S. Martino di Castrozza. *Preistoria Alpina*, 20:39–52.

Balboni, V. (2014). *Il sito mesolitico di Montagnana (PR) nel quadro del primo popolamento antico olocenico dell'area emiliana*. Tesi di laurea triennale, Università degli Studi di Ferrara.

Bañuls-Cardona, S., Montanari-Canini, G., Luzi, E., López-García, J., Berto, C., and Visentin, D. (2015). The small mammal study from Grottina dei Covoloni del Broion (Colli Berici, north - eastern Italy): palaeoenvironmental and palaeoclimatic characterization of Latest Pleistocene to Early Holocene layers. In *XV Edizione delle Giornate di Paleontologia, Palermo 27-29 Maggio 2015 - Volume dei Riassunti*, page 1.

Barbaza, M. and Heinz, C. (1992). La grotte-abri du Moulin (Troubat, Hautes-Pyrénées). Environnement et Archéologie. *Bulletin de la Société Botanique de France. Actualités Botaniques*, 139:685–695.

Barbaza, M. and Valdeyron, N. (1991). Tendances evolutives et attribution culturelle : Sauveterrien ou Sauveterroides. In *Fontfaurès en Quercy. Contribution à l'étude du Sauveterrien*, pages 229–241. Archives d'Ecologie Préhistorique 11. Toulouse.

Barbaza, M., Valdeyron, N., André, J., Briois, F., Martin, H., Philibert, S., Allios, D., and Lignon, E. (1991). *Fontfaurès en Quercy. Contribution à l'étude du Sauveterrien*. Archives d'Ecologie Préhistorique 11. Centre d'Anthropologie des Sociétés Rurales, Toulouse.

Barrière, C. (1972). *Rouffignac, l'archeologie. Fasc. 1*. Mémoire de l'Institut d'art préhistorique II. Toulouse.

Barrière, C. (1973). *Rouffignac, l'archéologie. Fasc. 2*. Mémoire de l'Institut d'art préhistorique II. Toulouse.

Barrière, C., Daniel, R., Delporte, H., Escalon de Fonton, M., Parent, R., Roche, J., and Rozoy, J.-G. (1972). Epipaléolithique-Mésolithique. Les armatures non géométriques. *Bulletin de la Société préhistorique française*, 69(1):364–375.

Barrière, C., Daniel, R., Delporte, H., Escalon de Fonton, M., Parent, R., Roche, J., Rozoy, J.-G., Tixier, J., and Vignard, E. (1969). Epipaléolithique-Mésolithique. Les microlithes géométriques. *Bulletin de la Société préhistorique française*, 66(1):355–366.

Bartolomei, G., Broglio, A., Cattani, L., Cremaschi, M., Guerreschi, A., Mantovani, E., Peretto, C., and Sala, B. (1982). I depositi würmiani del Riparo Tagliente. *Annali dell'Università di Ferrara. Sezione XV*, III(4):61–105.

Bartolomei, G., Broglio, A., and Palma di Cesnola, A. (1979). Chronostratigraphie et écologie de l'Épigravettien en Italie. In de Sonnevilles Bordes, D., editor, *La fin des temps glaciaires en Europe, Actes du Colloque International*, pages 297–324, Paris. CNRS.

Bassetti, M. and Borsato, A. (2007). Evoluzione geomorfologica della Bassa Valle dell'Adige dall'Ultimo Massimo Glaciale: sintesi delle conoscenze e riferimenti ad aree limitrofe. *Studi trentini di scienze naturali - Acta geologica*, 82(2005):31–42.

Bassetti, M., Cusinato, A., Dalmeri, G., Hrozny Kompatscher, N. M., Kompatscher, K., and Wierer, U. (2009). Updating on the Final Palaeolithic-Mesolithic transition in Trentino (NE Italy). *Preistoria Alpina*, 44(Hugo Obermaier Society. 49th Annual Meeting in Trento (10th - 14th of April, 2007)):121–135.

Battaglia, L., Broglio, A., Castelletti, L., Lanzinger, M., and Maspero, A. (1994). Abri Soman. *Preistoria Alpina*, 28/2(1992):291–298.

Bauman, Z. (2000). *Liquid Modernity*, volume 30. Polity Press.

Bazile-Robert, E. (1983). La Baume de Montclus (Gard). Étude anthracologique. *Etudes Quaternaires Languedociennes*, 3:25–32.

Bazzanella, M. (2004). L'industria in materia dura animale proveniente dal Riparo Cogola. *Preistoria Alpina*, 40(2004):155–158.

Bernabò Brea, M., Colombi, N., Grassi, G., Negrino, F., Ottomano, C., Strada, N., and Tramontano, A. (1998). Piacenza, loc. Le Mose, lotto IKEA. *Archeologia dell'Emilia – Romagna*, II(2):11–15.

Berruti, G. L. F. (2008). *Occupazioni mesolitiche nel Parmense: Approccio funzionale all'industria litica del sito sauveterriano di Collecchio (PR)*. PhD thesis, Università degli Studi di Ferrara.

Berto, C., Luzi, E., Guerreschi, A., Fontana, F., and Valletta, F. (2016). Small mammals from Mondeval de Sora (San Vito di Cadore, Belluno): paleoenvironmental differences between early and late Holocene. *Preistoria Alpina*, 48:69–72.

Bertola, S. (2016). Southern Alpine (Trento Plateau) and Northern Apennine flints: Ages, Distribution and Petrography. In Tomasso, A., Binder, D., Martino, G., Porraz, G., Simon, P., and Naudinot, N., editors, *Ressources lithiques, productions et transferts entre Alpes et Méditerranée Actes de la journée de la Société préhistorique française de Nice, 28-29 mars 2013. Séances de la Société préhistorique française, 5*, pages 55–75, Paris. Société préhistorique française.

Bertola, S., Bazzanella, M., and Wierer, U. (2004). Le risorse litiche utilizzate presso il sito di Galgenbiihel/Dos de la Forca (Salorno-BZ, Val d'Adige): modalità di approvvigionamento e direttrici di spostamento. In *Atti della XXXIX Riunione Scientifica, Firenze*, pages 367–371.

Bertola, S., Broglio, A., Cassoli, P. F., Cilli, C., Cusinato, A., Dalmeri, G., De Stefani, M., Fiore, I., Fontana, F., Giacobini, G., Guerreschi, A., Gurioli, F., Lemorini, C., Liagre, J., Malerba, G., Montoya, C., Peresani, M., Rocci Ris, A., Rossetti, P., Tagliacozzo, A., and Ziggiotti, S. (2007). L'Epigravettiano recente nell'area prealpina e alpina orientale. In Martini, F., editor, *L'Italia tra 15.000 e 10.000 anni fa. Cosmopolitismo e regionalità nel Tardoglaciale. Atti della Tavola rotonda (Firenze, 18 novembre 2005)*, chapter III, pages 39–94. Firenze.

Bertola, S. and Cusinato, A. (2005). Le risorse litiche dell'Altopiano di Folgaria e il loro utilizzo a Riparo Cogola. *Preistoria Alpina*, 40(2004):107–123.

Bertola, S., Fontana, F., and Visentin, D. (in press). Lithic raw material circulation and settlement dynamics in the Upper Palaeolithic of the Venetian Prealps (NE Italy). A key-role for palaeoclimatic and landscape changes across the LGM? In Borgia, V. and Cristiani, E., editors, *Out of Italy. Conference Proceedings*, page (in press).

Bertolini, M., Cristiani, E., Modolo, M., Visentini, P., and Romandini, M. (2016). Late Epigravettian and Mesolithic foragers of the eastern Alpine region: Animal exploitation and ornamental strategies at Riparo Biarzo (Northern Italy). *Quaternary International*, 423:73–91.

Bevilacqua, R. (1994). La Grotta Continenza di Trasacco. I livelli mesolitici ed epigravettiani. *Rivista di Scienze Preistoriche*, XLVI:3–39.

Beyries, S. (1987). *Variabilité de l'industrie lithique au Moustérien. Approche fonctionnelle sur quelques gisements français*. BAR International Series 328. Oxford.

Beyries, S. and Rots, V. (2008). The contribution of ethno-archaeological macro- and microscopic wear traces to the understanding of archaeological hide-working processes. *"Prehistoric Technology" 40 Years Later*, pages 21–28.

Biagi, P. (1994). Mesolithic Exploitation of the Highland Zone: a Case Study for the Southern Alps. *Preistoria Alpina*, 28 (1992):367–372.

Biagi, P. (1997). Recenti ricerche sul Mesolitico della Valcamonica (Brescia). *Bollettino del Centro Camuno di Studi Preistorici*, XXX:23–40.

Biagi, P., Castelletti, L., Cremaschi, M., Sala, B., and Tozzi, C. (1980). Popolazione e territorio nell'Appennino tosco-emiliano e nel tratto centrale del bacino del Po tra il IX e il V millennio. *Emilia Preromana*, 8:13–36.

Biagi, P., Nisbet, R., and Scaife, R. (1994). Man and vegetation in the southern alps: the valcamonica-valtrompia-valsabbia watershed (Northern Italy). *Monografie di "Natura Bresciana"*, 20(Highland Zone Exploitation in Southern Europe):133–141.

Biagi, P. and Starnini, E. (2016). The exploitation of the highland zones: the earliest Mesolithic hunters of the central Alpine arc. In Bacvarov, K. and Gleser, R., editors, *Southeast Europe and Anatolia in prehistory. Essays in honor of Vassil Nikolov on his 65th anniversary*, pages 33–40. Dr. Rudolf Habelt GmbH, Bonn.

Biagi, P., Starnini, E., and Voytek, B. A. (2008). The Mesolithic–Neolithic transition in the Trieste Karst (north-eastern Italy) as seen from the excavations at the Edera Cave. In Bonsall, C., Boroneant, V., and Radovanovic, I., editors, *The Iron Gates in Prehistory: New Perspectives*, pages 251–260. Bar intern edition.

Biddittu, I. (1971). Considerazioni sull'industria litica e la fauna del riparo della Sperlinga di San Basilio. *Bullettino di Paletnologia Italiana*, 80:64–76.

Bietti, A. (1990). The late Upper Paleolithic in Italy: An overview. *Journal of World Prehistory*, 4(1):95–155.

Binder, D. (1980). L'industrie lithique épipaléolithique de l'Abri Martin. *Bulletin du Musée d'Anthropologie Préhistorique de Monaco*, 24:333–344.

Binder, D. (1984). Systèmes de débitage laminaire par pression: exemples chasséens provençaux. In Tixier, J., Inizan, M., and Roche, H., editors, *Préhistoire de la pierre taillée, 2: économie du débitage laminaire: technologie et expérimentation: IIIe table ronde de technologie lithique. Meudin-Bellevue, octobre 1982*, pages 71–84, Paris. Cercle de Recherches et d'Etudes Préhistoriques.

Binder, D. (1987). *Le Néolithique ancien Provençal - Typologie et Technologie Des Outillages Lithiques*. CNRS Éditions, Paris.

Binford, L. R. (1968). Post-Pleistocene adaptations. In Binford, S. and Binford, L. R., editors, *New perspectives in archaeology*, pages 313–341. Aldine, Chicago.

Bintz, P. (1995). Le Pas de l'Échelle, Rovon (Isère). In Bintz, P. and Picavet, R., editors, *Épipaléolithique et Mésolithique en Europe, livret-guide de l'excursion Préhistorique et Quaternaire en Vercors, Actes du 5 e Colloque international de l'UISPP, commission XII (Grenoble, 18-23 septembre 1995)*, pages 80–83, Grenoble.

Bintz, P. (2003). Du Paléolithique final au Mésolithique dans les Alpes du Nord françaises: peuplements et environnements naturels. *Preistoria Alpina*, 39:143–153.

Bintz, P. and Pelletier, D. (1999). Le Mésolithique des Alpes françaises : bilan des connaissances. In Beeching, A., editor, *Circulations et identités culturelles alpines à la fin de la Préhistoire. Matériaux pour une étude, Programme CIRCALP, agence Rhône-Alpes pour les Sciences humaines*, pages 317–330. Centre d'Archéologie préhistorique, Valence, travaux du edition.

Blanchet, S., Kayser, O., Marchand, G., and Yven, E. (2006). Le Mésolithique moyen en Finistère : de nouvelles datations pour le groupe de Bertheaume. *Bulletin de la Société préhistorique française*, 103(3):507–517.

Bobœuf, M. (1998). Les Mésolithiques sauveterriens de la Vayssière (Aveyron). Productions lithiques et comportements. *Bulletin de la Société préhistorique française*, 95(4):475–504.

Bobœuf, M. (2003). Le Paléolithique final de la haute vallée de l'Aveyron, d'après les stratigraphies du site de Roquemissou (Aveyron). Point et remarques sur les connaissances. *Bulletin de la Société préhistorique française*, 100(2):253–266.

Bobœuf, M. and Bridault, A. (1997). Quelques données sur les occupations mésolithiques du clos de Poujol (Aveyron). *Bulletin de la Société préhistorique française*, 94(1):51–60.

Bordes, F. (1947). Etude Comparative des Differentes Techniques de Taille du Silex et des Roches Dures. *L'Anthropologie*, 51:1–29.

Bordes, F. (1961). *Typologie du Paléolithique ancien et moyen*. Delmas, Bordeaux.

Bordes, F. (1969). Traitement thermique du silex au Solutréen. *Bulletin de la Société préhistorique française*, 66(7):169.

Boschian, G., Mallegni, F., and Tozzi, C. (1995). The Epigravettian and Mesolithic site of Fredian Shelter (in Tuscany). *Quaternaria Nova*, V:45–80.

Bressan, F. and Guerreschi, A. (1984). Il Mesolitico in Friuli: il Riparo di Biarzo. *Preistoria Alpina*, 19:175–178.

Briois, F. (1991). Economie des matières première. Economie du débitage. In *Fontfaurès en Quercy. Contribution à l'étude du Sauveterrien*, pages 97–106. Archives d'Ecologie Préhistorique 11. Centre d'Anthropologie des Sociétés Rurales, Toulouse.

Briois, F. and Vaquer, J. (2009). L'abri de Buholoup. De l'Épipaléolithique au Néolithique ancien dans le piedmont central des Pyrénées. In *De Méditerranée et d'ailleurs... Mélanges offerts à Jean Guilaine*, pages 141–149. Archives d'Ecologie Préhistorique. Toulouse.

Briz, I., Clemente, I., Pijoan, J., Terradas, X., and Vila, A. (2005). Stone Tools In Ethnoarchaeological Contexts: Theoretical-Methodological Inferences. In Terradas, X., editor, *L'outillage lithique en contextes ethnarchéologiques. Lithic toolkits in Ethnoarchaeological contexts.*, BAR International series 1370, pages 1–7.

Brochier, J. L., Mandier, P., and Argant, J. (1991). Le cône détritique de la Drôme: Une contribution à la connaissance de l'Holocène du Sud-est de la France. *Quaternaire*, 2(2):83–99.

Broglio, A. (1971). Risultati preliminari delle ricerche sui complessi Epipaleolitici della Valle dell'Adige. *Preistoria Alpina*, 7:135–241.

Broglio, A. (1973). La preistoria della Valle Padana dalla fine del Paleolitico agli inizi del Neolitico: cronologia, aspetti culturali e trasformazioni economiche. *Rivista di Scienze Preistoriche*, XXVII:133–160.

Broglio, A. (1976). L'Epipaléolithique de la Vallée du Po. In *Les Civilisations du 8e au 5e millénaire avant notre ère en Europe : paléoenvironnement, structures d'habitat, outillages, économie. U.I.S.P.P., Coll.XIX*, pages 9–31.

Broglio, A. (1980). Culture e ambienti della fine del Paleolitico e del Mesolitico nell'Italia nord-orientale. *Preistoria Alpina*, 16:7–29.

Broglio, A. (1994). Mountain sites in the context of the North-East Italian Upper Palaeolithic and Mesolithic. *Preistoria Alpina*, 28 (1992):293–310.

Broglio, A. (2016). The discovery of the Mesolithic in the Adige Valley and the Dolomites (North-eastern Italy): A history of research. *Quaternary International*, 423:5–8.

Broglio, A., Corai, P., and Lunz, R. (1983). Risultati preliIninari delle prospezioni nei siti mesolitici della val Gardena e degli scavi al Plan de Frea. *Bullettin d'etudes prehistoriques alpines*, 15:19–53.

Broglio, A., De Stefani, M., and Peresani, M. (2006). I siti mesolitici di Cima XII (Altipiano dei Sette Comuni). In *Preistoria dell'Italia settentrionale. Studi in ricordo di Bernardino Bagolini Atti del Convegno, Udine settembre 2005*, pages 43–58.

Broglio, A. and Improta, S. (1995). Nuovi dati di cronologia assoluta del Paleolitico superiore e del Mesolitico del Veneto, del Trentino e del Friuli. In *Atti dell'Istituto Veneto di Scienze, Lettere ed Arti*, volume CLIII, pages 1–45.

Broglio, A. and Kozlowski, S. K. (1984). Tipologia ed evoluzione delle industrie mesolitiche di Romagnano III. *Preistoria Alpina*, 19(1983):93–148.

Broglio, A. and Lanzinger, M. (1986). Risultati preliminari degli scavi al Riparo Soman presso Ceraino in Valdadige. *Annuario storico della Valpolicella*, 1985-1986:9–28.

Broglio, A. and Lanzinger, M. (1990). Considerazioni sulla distribuzione dei siti tra la fine del Paleolitico superiore e l'inizio del Neolitico nell'Italia nord-orientale. In Biagi, P., editor, *The Neolithisation of the Alpine Region. Monografie di Natura Bresciana 13*, pages 53–69.

Bronk Ramsey, C. (2009). Bayesian Analysis of Radiocarbon Dates. *Radiocarbon*, 51(1):337–360.

Brown, K., Marean, C., Herries, A., Jacobs, Z., Tribolo, C., Braun, D., Roberts, D., Meyer, M., and Bernatchez, J. (2009). Fire as an engineering tool of early modern humans. *Science*, 325(5942):859–862.

Calattini, M. (1986). Grotta delle Mura (Monopoli, prov. Bari). *Rivista di Scienze Preistoriche*, XL(2):382–383.

Calattini, M. and Tessaro, C. (2016). The mesolithic at Mura cave. *Preistoria Alpina*, 48:159–170.

Carton, A., Bondesan, A., Fontana, A., Meneghel, M., Miola, A., Mozzi, P., Primon, S., and Surian, N. (2009). Geomorphological evolution and sediment transfer in the Piave River system (northeastern Italy) since the Last Glacial Maximum. *Géomorphologie : relief, processus, environnement*, 3:155–174.

Cattani, L. (1977). La Grottina dei Covoloni del Broion (Colli Berici, Vicenza). Analisi pollinica. *Rivista di Scienze Preistoriche*, XXXII(1-2):287–296.

Cesco Frare, P. and Mondini, C. (2005). Il Mesolitico in Provincia di Belluno. Il quadro dei ritrovamenti. *Archivio storico di Belluno Feltre e Cadore*, LXXVI(329).

Champagne, F., Champagne, C., Jauzon, P., and Novel, P. (1990). Le site préhistorique des Fieux à Miers (Lot). Etat actuel de la recherche. *Gallia préhistoire*, 32:1–28.

Chesnaux, L. (2014a). *Réflexions sur le microlithisme en France au cours du Premier Mésolithique (Xè-VIIIè millénaire av. J.C.). Approche technologique, expérimentale et fonctionnelle*. Phd thesis, Université de Paris 1 Panthéon-Sorbonne.

Chesnaux, L. (2014b). Variabilité de la mise en forme de géométriques triangulaires du Premier Mésolithique : vers une simplification de la fabrication des barbelures ? Analyse techno-fonctionnelle comparative des assemblages microlithiques de Saint-Lizier à Creysse (24) et de de la Grande Rivoire à Sassenage (38). *P@lethnologie*, 6:54–64.

Claud, É. (2008). *Le statut fonctionnel des bifaces au Paléolithique moyen récent dans le Sud-Ouest de la France. Étude tracéologique intégrée des outillages des sites de La Graulet, La Conne de Bergerac, Combe Brune 2, Fonseigner et Chez-Pinaud / Jonzac*. PhD thesis, Université Bordeaux I.

Collins, M. (1973). Observations on thermal treatment of chert in the Solutrean of Laugerie Haute, France. *Proceedings of the Prehistoric Society*, 39:461–466.

Colombo, L., Martinelli, E., Motella, S., Castelletti, L., Fontana, F., and Michetti, A. M. (2016). A contribution to landscape reconstruction in the basin of Mondeval de Sora (Belluno Dolomites, N-E Italy): preliminary analysis of an anthracological sample from the Mesolithic layers of site VF1 , sectors I and III. *Preistoria Alpina*, 48:245–253.

Corazza, S., Dal Santo, N., and Scardia, G. (2009). L'area delle risorgive nel sistema insediativo mesolitico: alcuni esempi dal pordenonese. *Gortania. Atti del Museo Friulano di Storia Naturale. Geologia, Paleontologia, Paletnologia*, 31:141–169.

Coulonges, L. (1928). Le gisement préhistorique du Martinet à Sauveterre-la-Lémance (Lot-et-Garonne). *L'Anthropologie*, XXXVIII:495–503.

Coulonges, L. (1930). Le Gisement Préhistorique du Martinet à Sauveterre-la-Lémance (Lot-et-Garonne). *Bulletin de la Société préhistorique de France*, 27(3):174–179.

Coulonges, L. (1954). Le Sauveterrien. *Bulletin de la Société préhistorique de France*, 51(8. Les grandes civilisations préhistoriques de la France. Livre Jubilaire de la Société Préhistorique Française 1904 - 1954):70–71.

Coulonges, L. (1963). Magdalénien et périgordien post-glaciaires: la grotte de La Borie del Rey (Lot-et-Garonne). *Gallia Préhistoire*, 6:1–29.

Crabtree, D. and Butler, B. (1964). Notes on experiments in flint knapping: 1. Heat treatment of silica minerals. *Tebiwa*, 7:1–6.

Cremaschi, M., Biagi, P., Castelletti, L., Leoni, L., Mazzanti, M., and Rodolfi, E. (1984). Il sito mesolitico di Monte Bagioletto nel quadro delle variazioni ambientali oloceniche dell'Appennino Tosco-Emiliano. *Emilia Preromana*, 9/10:11–46.

Cremaschi, M., Guerreschi, A., and Steffè, G. (1990). Il sito mesolitico di Cava Due Portoni a Borgo Pianigale (Bologna). In Iodice, M. E., editor, *Borgo Panigale. Da villaggio mesolitico a quartiere cittadino*, pages 11–20. CRABP, Bologna.

Cremaschi, M. and Nicosia, C. (2012). L' aggradation au Subboréal le long de la marge apennine de la plaine centrale du Pô: Aspects géomorphologiques, etgeóarchéologiques. *Geomorphologie: Relief, Processus, Environnement*, 2:155–174.

Cristiani, E. (2009). Osseous artefacts from the Mesolithic levels of Pradestel rockshelter, (north-eastern Italy): A morphological and techno-functional analysis. *Preistoria Alpina*, 44:179–203.

Cristiani, E. (2012). Ornamental traditions of the Late Pleistocene and Early Holocene foragers in the Eastern Alps: the case of Riparo Biarzo. *Gortania. Geologia, Paleontologia, Paletnologia*, 34:89–102.

Cristiani, E., Pedrotti, A., and Gialanella, S. (2009). Tradition and innovation between the Mesolithic and Early Neolithic in the Adige Valley (Northeast Italy). New data from a functional and residues analyses of trapezes from Gaban rockshelter. *Documenta Praehistorica*, 36(1):191–205.

Crombé, P., Perdaen, Y., and Sergant, J. (2008). La transition du Mésolithique ancien au Mésolithique moyen/récent dans le nord-ouest de la Belgique : quelques réflexions concernant l'occupation du territoire. In *Le début du Mésolithique en Europe du Nord-Ouest : Actes de la table ronde d'Amiens, 9 et 10 octobre 2004*, pages 195–204.

Crotti, P. (2003). Mesolithic hunter-gatherers in western Switzerland: economy and mobility. *Preistoria Alpina*, 39:155–163.

Crotti, P. (2009). Le Prealpi Svizzere Occidentali nel quadro del popolamento in quota delle Alpi Centrali, nel Paleolitico fi nale e nel Mesolitico. In Peresani, M. and Ravazzi, C., editors, *Le Foreste dei Cacciatori Paleolitici. Ambiente e popolamento umano in Cansiglio tra Tardoglaciale e Postglaciale*, pages 229–250.

Crotti, P. and Bullinger, J. (2013). Occupation des milieux montagnards au cours de l'Epipaléolithique et du Mésolithique en Suisse occidentale. *Preistoria Alpina*, 47:77–83.

Crotti, P., Guélat, M., Bullinger, J., and Pignat, G. (2016). The rockshelter of Château-d'Œx : pedosedimentary record of human occupations in the Swiss Prealps from the Late Glacial to the Mid-Holocene. *Preistoria Alpina*, 48:21–31.

Crotti, P. and Pignat, G. (1994). L'utilisation des étages montagnards durant le Mésolithique dans les Alpes suisses. *Preistoria Alpina*, 28(1992):275–284.

Curdy, P., Bullinger, J., Crotti, P., Valsecchi, V., and Tinner, W. (2010). Recherches archéologiques dans les régions du Simplon et de l'Albrun (Valais et Piémont), du Mésolithique à l'époque romaine. In *Archéologie de la montagne européenne : actes de la table ronde internationale de Gap, 29 septembre - 1er octobre 2008*, pages 185–195.

Curdy, P., Leuzinger-Piccand, C., and Leuzinger, U. (2003). Zermatt Alp Hermettji et les cols secondaires du Valais. In *ConstellaSion : hommage à Alain Gallay*, pages 73–88.

Cusinato, A. (2003). *Adattamenti all'ambiente montano ed evoluzione culturale dei cacciatori-raccoglitori tra la fine del Tardiglaciale e l'inizio dell'Olocene. Apporto dell'analisi tecno-tipologica dell'industria litica del sito di Riparo La Cogola (Trento, Italia).* Tesi di dottorato, Università degli Studi di Ferrara.

Cusinato, A., Dalmeri, G., Kompatscher, K., and Hrozny Kompatscher, N. M. (2005). Gli insiemi litici della sequenza preistorica di Riparo Cogola e la problematica relativa alla transizione tra Epigravettiano e Mesolitico in area alpina. *Preistoria Alpina*, 40(2004):125–154.

Dachary, M., Merlet, J.-c., Miqu, M., Mallye, J.-b., Gall, O. L. E., Eastham, A., Miquéou, M., Le Gall, O., and Le, O. (2013). Les occupations mésolithiques de Bourrouilla à Arancou (Pyrénées-Atlantiques, France). *Paléo. Revue d'archéologie préhistorique*, 24(2013):79–102.

Dachary, M., Plassard, F., and Valladas, H. (in press). La grotte de Rouffignac (Dordogne, France) : Un gîte de matière première exploité au Mésolithique. *Paléo. Revue d'archéologie préhistorique*.

Dalmeri, G. (2005). Studi sul Riparo Cogola (Carbonare di Folgaria - Trento). Introduzione generale. *Preistoria Alpina*, 40(2004):91–98.

Dalmeri, G., Cusinato, A., Neri, S., and Nicolodi, F. (2008). Le industrie mesolitiche di Riparo Pradestel (Trento). Aspetti tipologici ed evolutivi. *Preistoria Alpina*, 43:131–186.

Dalmeri, G., Duches, R., Avanzini, M., Bassetti, M., Flor, E., and Neri, S. (2013). Frequentazione delle medie quote montane durante il Dryas recente: nuove informazioni dal sito epigravettiano di Palù Echen (Altopiano di Folgaria, Trentino). *Preistoria Alpina*, 47:153–181.

Dalmeri, G., Kompatscher, K., Hrozny Kompatscher, N. M., Bassetti, M., Cusinato, A., and Piazzi, O. (2005a). Dinamiche comportamentali degli ultimi cacciatori-raccoglitori in area alpina. Il caso di studio del sito LR3 del Laghetto delle Regole (Castelfondo, Trento). *Preistoria Alpina*, 40(2004):5–26.

Dalmeri, G., Kompatscher, K., Kompatscher, M. H., Bassetti, M., Cusinato, A., and Piazzi, O. (2005b). Dinamiche comportamentali degli ultimi cacciatori raccoglitori in area alpina. Il caso di studio del sito LR3 del Laghetto delle Regole (Castelfondo, Trento). *Preistoria Alpina*, 40(2004):5–26.

Dalmeri, G. and Lanzinger, M. (1994). Risultati preliminari delle ricerche nei siti mesolitici del Lago delle Buse, nel Lagorai (Trentino). *Preistoria alpina*, 28(1992):317–349.

Dalmeri, G., Mottes, E., and Nicolis, F. (2002). La sepoltura mesolitica di Mezzocorona-Borgonuovo (Trento). Prime considerazioni. In *Atti della XXXIII Riunione Scientifica dell'Istituto Italiano di Preistoria e Protostoria, Volume 1*, pages 189–204, Firenze.

Dalmeri, G. and Pedrotti, A. (1994). Distribuzione topografica dei siti del Paleolitico superiore finale e Mesolitico in Trentino Alto-Adige e nelle Dolomiti Venete (Italia). *Preistoria Alpina*, 28(1992):247–267.

D'Angelo, E. (2004). Le vie della selce nell'Appennino centrale. Il caso di Grotta di Pozzo (AQ): livelli mesolitici. *Origini*, XXVI:65–86.

Darmedru, D. and Onoratini, G. (2003). Apports du site de Montclus (Gard) à l'origine et à la filiation du Montclusien (Mésolithique). *L'Anthropologie*, 107(3):365–392.

De Marchi, L. (2003). Gli scavi nei prati Longarola sul Monte Montagnana e nel pianoro La Bratta sul Monte Cavalcalupo, sulla displuviale Val Parma - Val Baganza. *Acta Naturalia de "L'Ateneo Parmense"*, 38(4):139–157.

Delhon, C., Thiébault, S., Brochier, J.-L., and Berger, J.-F. (2010). Au Tardiglaciaire Et À L'Holocène Ancien En Moyenne Vallée Du Rhône D'Après Les Données Anthracologiques. *Quaternaire*, 21(3):281–293.

Group d'Etudes de l'Epipaléolithique Mésolithique (1975). Epipaléolithique-Mésolithique. L'outillage du fonds commun . 1. Grattoirs, éclats retouchés, burins, perçoirs. *Bulletin de la Société préhistorique française. Études et travaux*, 72(1):319–332.

Di Anastasio, G., Mondini, C., Peresani, M., and Villabruna, A. (1995). Altopiano del Cansiglio. Scavi di siti paleolitici e mesolitici. *Quaderni di Archeologia del Veneto*, XI:11–18.

Di Maio, P. (2006). *Il sito mesolitico di Cianciavero. Considerazioni sul popolamento delle Alpi Lepontine nell'Olocene antico*. Tesi di dottorato, Università degli Studi di Ferrara.

Domanski, M. and Webb, J. A. (1992). Effect of heat treatment on siliceous rocks used in prehistoric lithic technology. *Journal of Archaeological Science*, 19(6):601–614.

Drescher-Schneider, R. (2009). La storia forestale delle Alpi Sud-Orientali e del margine pedemontano durante gli ultimi 25 mila anni. In Peresani, M. and Ravazzi, C., editors, *Le Foreste dei Cacciatori Paleolitici. Ambiente e popolamento umano in Cansiglio tra Tardoglaciale e Postglaciale*, number 1999 in Supplemento al Bollettino della Società Naturalisti Silvia Zenari, pages 27–64, Pordenone.

Duches, R., Avanzini, M., Bassetti, M., Flor, E., Neri, S., and Dalmeri, G. (2014). Évolution de la mobilité épigravettienne durant le Dryas récent : quelles nouvelles informations pour l'Italie nord-orientale ? In Langlais, M., Naudinot, N., and Peresani, M., editors, *Les groupes culturels de la transition Pléistocène-Holocène entre Atlantique et Adriatique. Actes de la séance de la Société préhistorique française de Bordeaux, 24-25 mai 2012.*, pages 185–203.

Ducrocq, T. (2013). The 'Beuronian with crescents' in Northern France: the beginnings of a palethnological approach. In Valentin, B., Souffi, B., Ducrocq, T., Fagnart, J.-P., Séara, F., and Verjux, C., editors, *Mesolithic Palethnography. Research on open-air sites between Loire and Neckar. Proceedings from the international round-table meeting, Paris, November 26–27, 2010 (Séances de la Société préhistorique française 2-2)*, pages 189–206, Paris. Société préhistorique française.

Eriksen, B. V. (2006). Colourful Lithics – the "Chaîne Opératoire" of Heat Treated Chert Artefacts in the Early Mesolithic of Southwest Germany. In Kind, C. J., editor, *After the Ice Age. Settlements, subsistence and social development in the Mesolithic of Central Europe. Materialhefte zur Archäologie in Baden-Württemberg, Heft 78*, pages 147–153, Stuttgart. Konrad Theiss Verlag.

Escalon De Fonton, M. (1966). Du Paléolithique supérieur au Mésolithique dans le Midi méditerranéen. *Bulletin de la Société préhistorique française*, 63(1):66–180.

Escalon De Fonton, M. (1969). La Baume de Montclus (Gard). Campagne de fouilles 1969. *Cahiers ligures de préhistoire et d'archéologie*, 19(1970):106–110.

Escalon De Fonton, M. (1971). La stratigraphie du gisement préhistorique de la Baume de Montclus (Gard). In *Mélanges de Préhistoire, d'archéocivilisation et d'ethnologie offerts à M. Varagnac*, pages 263–278. Paris, e.p.h. étu edition.

Fabbri, P., Ingravallo, E., and Mangia, A., editors (2003). *Grotta Romanelli nel centenario della sua scoperta (1900-2000).* Congedo editore, Galatina.

Farabegoli, E., Fontana, F., Guerreschi, A., and Nenzioni, G. (1994). Il sito mesolitico dell'I.N.F.S. di Colunga (Ozzano Emilia - Bologna). *Bullettino di Paletnologia Italiana*, 85:73–133.

Fat Cheung, C., Chevallier, A., Bonnet-Jacquement, P., Langlais, M., Ferrié, J.-G., Costamagno, S., Kuntz, D., Laroulandie, V., Mallye, J.-B., Valdeyron, N., and Ballista, S. (2014). *Comparaison des séquences aziliennes entre Dordogne et Pyrénées: état des travaux en cours*.

Fedele, F. (1990). Madesimo e Campodolcino (So), Località Pian dei Cavalli e Borghetto. Siti paleo-mesolitici e della preistoria recente. *Notiziario della Soprintendenza Archeologica della Lombardia*, pages 49–52.

Fedele, F. (2013). I Covoloni del Broion (colli Berici, VI). In De Marinis, R. C., editor, *L'età del Rame. La pianura Padana e le Alpi al tempo di Ötzi*, pages 450–456. Brescia.

Fedele, F. G. and Wick, L. (1996). Glacial/Postglacial transition South of Spülgen Pass: environment and human activity. *Il Quaternario. Italian Journal of Quaternary Sciences*, 9(2):541–550.

Ferrari, P. (2011). Solignano (PR) Progetto per la realizzazione di un nuovo fabbricato produttivo in località Rubbiano, tra via Vittorio Veneto – Via Galilei. Relazione geoarcheologica. Technical report, GEA s.r.l. Ricerca e Documentazione Archeologica, Parma.

Fiore, I., Lo Vetro, D., Pino Uria, B., and Tagliacozzo, A. (2016). Grotta del Santuario della Madonna at Praia a Mare (Cosenza, Italy): ritual pits and combustion structures. Spatial organization, fauna and lithic industries of the Mesolithic levels (2008-2011 excavations). *Preistoria Alpina*, 48:199–214.

Fiore, I. and Tagliacozzo, A. (2004). Riparo Cogola: il contesto paleoecologico e lo sfruttamento delle risorse animali tra Epigravettiano e Mesolitico antico. *Preistoria Alpina*, 40:159–186.

Fischer, A., Hansen, P. V., and Rasmussen, P. (1984). Macro and Micro Wear Traces on Lithic Projectile Points. *Journal of Danish Archaeology*, 3:19–46.

Flannery, K. (1969). Origins and ecological effects of early domestication in Iran and the Near East. In Ucko, J. and Dimbleby, G., editors, *The domestica- tion and exploitation of plants and animals*, pages 73–100. Aldine, Chicago.

Flor, E., Fontana, F., and Peresani, M. (2011). Contribution to the study of Sauveterrian technical systems. Technological analysis of the lithic industry from layers AF-AC1 of Romagnano Loc III rockshelter (Trento). *Preistoria Alpina*, 45:193–219.

Fontana, A., Mozzi, P., and Bondesan, A. (2008). Alluvial megafans in the Venetian–Friulian Plain (north-eastern Italy): evidence of sedimentary and erosive phases during Late Pleistocene and Holocene. *Quaternary International*, 189(1):71–90.

Fontana, A., Mozzi, P., and Bondesan, A. (2010). Late pleistocene evolution of the Venetian–Friulian Plain. *Rend. Fis. Acc. Lincei*, 21:181–196.

Fontana, F. (2011). De saison en saison : réévaluation du statut fonctionnel des habitats sauveterriens du secteur nord-oriental de la péninsule italienne et implications sur les dynamiques d'occupation du territoire des groupes humains. In Bon, F., Costamagno, S., and Valdeyron, N., editors, *Haltes de chasse en Préhistoire. Quelles réalités archéologiques ? Actes du colloque international du 13 au 15 mai 2009, Université Toulouse II - Le Mirail, P@lethnologie 3*, pages 295–312.

Fontana, F. and Cremona, M. G. (2008). Human occupation at the Southern Po Plain margin in the Early Mesolithic: the contribution of technological and typological studies. In Aubry, T., Almeida, F., Araùjo, A. C., and Tiffagom, M., editors, *Space and time: which diachronies, which synchronies, which scales? and Typology vs. technology. Proceedings of the XV UISPP World Congress (Lisbon, 4-9 September 2006). Session C64 and C65*, volume 21, pages 207–214. Archaeopress.

Fontana, F., Cremona, M. G., Cavallari, P., Gazzoni, V., Palavanchi, S., Guerreschi, A., Cremona, M. G., Cavallari, P., Gazzoni, V., and Palavanchi, S. (2009a). Variability of lithic technical systems in the Sauveterrian of the Southern Po Plain area (Northern Italy). *Journal of Human Evolution*, 24(2):153–164.

Fontana, F., Cremona, M. G., Ferrari, E., Guarisco, F., and Mengoli, D. (2009b). Peope and their land at the southern margins of the central Po Plain in the Early Mesolithic. In McCartan, S. B., Shulting, R., Warren, G., and Woodman, P., editors, *Mesolithic Horizons Papers presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005*, volume 1, pages 296–302. Oxbow Books.

Fontana, F., Ferrari, S., and Visentin, D. (2013). A review on the Mesolithic of the Emilian Apennines and Southern Po Plain. *Preistoria Alpina*, 47:17–30.

Fontana, F., Flor, E., and Duches, R. (2016a). Technological continuity and discontinuity in the Romagnano Loc III rock shelter (NE Italy) Mesolithic series. *Quaternary International*, 423:252–265.

Fontana, F., Govoni, L., Guerreschi, A., Padoanello, S., Siviero, A., Thun Hohenstein, U., and Ziggiotti, S. (2009c). L'occupazione sauveterriana di Mondeval de Sora 1, settore I (San Vito di Cadore, Belluno) in bilico tra accampamento residenziale e campo da caccia. *Preistoria Alpina*, 44:207–226.

Fontana, F. and Guerreschi, A. (2009). Variability of lithic resource exploitation systems in northern Italy during the early Holocene: the case-studies of Mondeval de Sora (Belluno) and I.N.F.S. (Bologna). In McCartan, S., Schulting, R., Warren, G., and Woodman, P., editors, *Mesolithic Horizons Papers presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005*. Oxbow Books.

Fontana, F., Guerreschi, A., Bertola, S., Cremona, M. G., Cavulli, F., Falceri, L., Gajardo, A., Montoya, C., Ndiaye, M., and Visentin, D. (2015). I livelli più antichi della serie epigravettiana "interna" di Riparo Tagliente: sfruttamento delle risorse litiche e sistemi tecnici. In Leonardi, G. and Tiné, V., editors, *Preistoria e Protostoria del Veneto, Studi di Preistoria e Protostoria, 2*, pages 43–52. Firenze.

Fontana, F., Guerreschi, A., and Vullo, N. (2000). Le site mésolithique de l'Alpe Veglia (Alpi Lepontine, Italia): analyse techno-typologique et spatiale. In *Actes de la table ronde "Épipaleolithique et Mesolithiqe" Laussane, 21-23 novembre, 1997. Cahiers d'archéologie romande, 81*, pages 259–265.

Fontana, F., Palavanchi, S., Bertola, S., and Cremona, M. G. (2017). L'area di Le Mose (Piacenza) nell'Olocene antico: un sito estensivo di cacciatori-raccoglitori Sauveterriani nella Pianura Padana. In Bernabò Brea, M., editor, *Preistoria e Protostoria dell'Emilia Romagna - I*, Studi di Preistoria e Protostoria - 3, I, pages 91-100. Firenze.

Fontana, F., Pasi, E., Petrucci, G., and Guerreschi, A. (2009d). Premiers résultats de l'étude des niveaux sauveterriens du site 1, secteur III de Mondeval de Sora (Dolomites, Belluno, Italie). *Rivista di Scienze Preistoriche*, LIX:79–92.

Fontana, F. and Visentin, D. (2016). Between the Venetian Alps and the Emilian Apennines (Northern Italy): Highland vs. lowland occupation in the early Mesolithic. *Quaternary International*, 423:266–278.

Fontana, F., Visentin, D., Mozzi, P., Abbà, T., Corradi, R., Gerhardinger, E., and Primon, S. (2016b). Looking for the Mesolithic in the Venetian Plain : first results from the Sile river springs (North-Eastern Italy). *Preistoria Alpina*, 48:109–113.

Fontana, F. and Vullo, N. (2000). Organisation et fonction d'un camp de base saisonnier au coeur des Dolomites: le gisement mésolithique de Mondeval de Sora (Belluno, Italie). In Richard, A., Cupillard, C., Richard, H., and Thévenin, A., editors, *Les derniers chasseurs-cueilleurs d'Europe occidentale, Actes du colloque international de Besançon, octobre 1998*, volume Collection of *Environnement, sociétés et archéologie, 1*, pages 197–208, Besançon.

Franco, C. (2011). *La fine del Mesolitico in Italia. Identità culturale e distribuzione territoriale degli ultimi cacciatori-raccoglitori*. Società per la Preistoria e Protostoria della Regione Friuli-Venezia Giulia, Trieste.

Frigo, G. and Martello, G. (1994). I siti mesolitici a Sud di Cima XII (Altopiano dei Sette Comuni). *Preistoria Alpina*, 27(1991):163–171.

Gala, M., Fiore, I., and Tagliacozzo, A. (2016a). The raptors in the Mesolithic at the Grotta del Santuario della Madonna at Praia a Mare (Cosenza, Italy). *Preistoria Alpina*, 48:215–229.

Gala, M., Tagliacozzo, A., and Wierer, U. (2016b). Bird remains from the Mesolithic site Galgenbühel / Dos de la Forca (Salurn, Bozen/Bolzano, Italy). *Preistoria Alpina*, 48:43–51.

Gambari, F., Ghiretti, A., and Guerreschi, A. (1991). Il sito mesolitico di Cianciàvero nel Parco Naturale di Alpe Veglia (Alpi Lepontine, Val d'Ossola, Novara). *Preistoria Alpina*, 25(1989):47–52.

Gassin, B. (1996). *Évolution socio-économique dans le Chasséen de la grotte de l'Église supérieure (Var). Apport de l'analyse fonctionnelle des industries lithiques*. Monographies du CRA, 17. CNRS Éditions, Paris.

Geneste, J. M. and Plisson, H. (1990). Technologie fonctionelle des pointes a cran Solutréennes: l'apport des nouvelles données de la grotte de Combe Saunière (Dordogne). In *Les Industries à pointes foliacées du Paléolithique supérieur européen, Krakòw 1989. ERAUL 42*, pages 293–320. Liège.

Gheser, N. and Martini, F. (1985). Il Mesolitico di Sammartina. *Rivista di Scienze Preistoriche*, XL(1-2):137–199.

Ghiretti, A. and Guerreschi, A. (1990). Il Mesolitico nelle Valli di Taro e Ceno (Parma). *Preistoria Alpina*, 24:69–102.

Ginestet, J.-P., Bintz, P., Chaix, L., Evin, J., and Olive, C. (1984). L'abri sous roche de la Vieille Église, La Balme-de-Thuy (Haute-Savoie), premiers résultats. *Bulletin de la Société préhistorique française*, 81(10):320–342.

Gob, A. (1981). *Le Mésolithique dans le bassin de l'Ourthe*. mémoire n° 3. Société wallonne de palethnologie, Liège.

González Urquijo, J. and Ibáñez Estévez, J. (1994). *Metodología de análisis funcional de instrumentos tallados en sílex*. Universida de Deusto.

Gouraud, G. (1980). Les couteaux à encoches basilaires des gisements à microlithes en Basse-Loire. *Bulletin de la Société préhistorique française*, 77(9):277–279.

Gouraud, G. and Thévenin, A. (2000). Les couteaux à encoches basilaires. *Revue archéologique de l'ouest*, 17(1):87–99.

Grifoni Cremonesi, R., Serradimigni, M., and Usala, M. (2011). Le campagne di scavo dal 2001 al 2009 nella Grotta Continenza di Trasacco (AQ). I livelli dell'Epigravettiano finale, del Mesolitico e del Neolitico antico. In *Il Fucino e le aree limitrofe nell'antichità. Atti del III Convegno di Archeologia in ricordo di Walter Cianciusi. Castello Orsini, Avezzano, 13-15 novembre 2009*, pages 27–39.

Grimaldi, S. (2006). Radiocarbon dating of the early Mesolithic Colbricon site (North-Eastern Italian Alps). *Journal of Anthropological Sciences*, 84:137–145.

Gueret, C. (2013a). Character and variability of Early Mesolithic toolkits in Belgium and Northern France: the contribution of a functional approach. In Valentin, B., Souffi, B., Ducrocq, T., Fagnart, J.-P., Séara, F., and Verjux, C., editors, *Mesolithic Palethnography. Research on open-air sites between Loire and Neckar. Proceedings from the international round-table meeting, Paris, November 26–27, 2010 (Séances de la Société préhistorique française 2-2)*, pages 147–167, Paris. Société préhistorique française.

Gueret, C. (2013b). *L'outillage du Premier Mésolithique dans le Nord de la France et en Belgique. Eclairages fonctionnels*. PhD thesis, Université Paris I Pantheon-Sorbonne.

Guerreschi, A. (1975). L'epigravettiano di Piancavallo (Pordenone). *Preistoria Alpina*, 11:255–293.

Guerreschi, A. (1984a). Il sito epigravettiano di Andalo (Trento) ed alcune considerazioni sull'Epigravettiano finale nel nord Italia. *Preistoria Alpina*, 20:15–38.

Guerreschi, A. (1984b). Tendenze evolutive in senso mesolitico dell'Epigravettiano italico finale dell'Italia nord-orientale. *Preistoria Alpina*, 19(1983):209–212.

Guerreschi, A., editor (1996). *Il sito preistorico del Riparo di Biarzo, Valle del Natisone, Friuli*. Museo Friulano di Storia Naturale edition.

Guilbault, H. (2011). *Introduction méthodologique et pratique aux approches fonctionnelles appliquées au Premier Mésolithique : le cas des couteaux de Rouffignac (Dordogne)*. Master 2, Université Toulouse II Le Mirail.

Guilbert, R. (2000). *Gestion des industries lithiques Mesolithiques du sud-est de la France*. PhD thesis.

Guilbert, R. (2001). « Le Sansonnet » et « Les Agnels » (Vaucluse), un exemple de fragmentation thermique intentionnelle du silex au Sauveterrien. *Paléo. Revue d'archéologie préhistorique*, 13:245–250.

Guilbert, R. (2003). Les systèmes de débitage de trois sites sauveteriennes dans le Sud-Est de la France. *Bulletin de la Société préhistorique française*, 100(3):463–478.

Guilbert, R., Philibert, S., and Peresani, M. (2006). L'outil expédient: une partie intégrante de la production mésolithique. In Astruc, L., Bon, F., Léa, V., Milcent, P.-Y., and Philibert, S., editors, *Normes techniques et pratiques sociales. De la simplicité des outillages pré-et protohistoriques. XXVI rencontres internationales d'archéologie et d'histoire d'Antibes*, pages 161–171, Antibes. Éditions APDCA.

Helmer, D. and Monchot, H. (2006). Un site mésolithique de chasse à l'aurochs (La Montagne, Sénas, Bouches-du-Rhône). *Anthropozoologica*, 41(2):215–228.

Henry, A., Valdeyron, N., Bouby, L., and Thery-Parisot, I. (2012). History and evolution of Mesolithic landscapes in the Haut-Quercy (Lot, France): New charcoal data from archaeological contexts. *The Holocene*, 23(1):127–136.

Hinout, J. (1990). Evolution des cultures épipaléolithiques et mésolithiques dans le Bassin parisien. *Revue archéologique de Picardie*, 3(1):5–14.

Hinout, J. (1992). Le gisement sauveterrien ancien à denticulés de la grotte de Chateaubriand à Buthiers (Seine-et-Marne). *Revue archéologique de Picardie*, 3(1):5–24.

Inizan, M.-L., Ballinger, M., Roche, H., and Tixier, J. (1999). *Technology and Terminology of Knapped Stone*.

Jean, C. (1973). Datation C14 du Mésolithique de la Baume Fontbrégoua, à Salernes, Var. *Bulletin de la Société préhistorique française*, 70(4):99–100.

Jean, C. (1975). Le Mésolithique de la Baume Fontbrégoua à Salernes (Var). *Cahiers ligures de préhistoire et d'archéologie*, 24:110–117.

Jochim, M. (2006). Regional perspectives on Early Mesolithic land use in southwestern Germany. *Journal of Anthropological Archaeology*, 25(2):204–212.

Jochim, M. A. (2008). Eight: The Mesolithic of the Upper Danube and Upper Rhine. In Bailey, G. and Spikins, P., editors, *Mesolithic Europe*, pages 203–220. Cambridge University Press.

Keeley, L. H. (1980). *Experimental Determination of Stone Tool Uses: A Microwear Analysis*. University of Chicago Press.

Khedhaier, R. (2003). *Contribution à l'étude fonctionnelle des industries lithiques sauveterriennes : Comparaison à deux sites du Sud-Est de la France (Le Sansonnet et Le Pey de Durance) et de la Suisse occidentale (La Baume d'Ogens et Le Château- d'Oex)*. Thèse de doctorat, préhistoire et anthropologie, Université d'Aix-Marseille1.

Kind, C. J. (2006). Transport of lithic raw material in the Mesolithic of southwest Germany. *Journal of Anthropological Archaeology*, 25(2):213–225.

Kind, C. J. (2009). The Mesolithic in southwest Germany. *Preistoria Alpina*, 44:137–145.

Kompatscher, K., Hrozny Kompatscher, N. M., Bassetti, M., Castiglioni, E., Rottoli, M., and Wierer, U. (2016). Mesolithic settlement and mobility patterns at high altitudes. The site of Staller Sattel STS 4A (South Tyrol, Italy). *Quaternary International*, 423:23–48.

Kozłowski, S. K. (1973). Introduction to the History of Europe in Early Holocene. In Kozłowski, S. K., editor, *Mesolithic in Europe*, pages 331–366. Warsaw University Press.

Kozłowski, S. K. (1975). *Cultural differentiation of Europe from 10th to 15th millennium B.C.* Warsaw University Press.

Kozłowski, S. K. (1976). Les courants interculturels dans le Mésolithique de l'Europe occidentale. In *Les civilisations du 8e au 5e millénaire avant notre ère en Europe, Colloque XIX, U.I.S.P.P., Nice- Prétirage*, pages 135–160.

Kozłowski, S. K. (1980). *Atlas of the Mesolithic in Europe*. Warsaw University Press.

Kozlowski, S. K. (2009). Mapping the European Mesolithic. In *Mesolithic Horizons. Papers presented at the Seventh International Conference on the Mesolithic in Europe, Belfast 2005*, pages XX–XXVI.

Kozlowski, S. K. and Dalmeri, G. (2002). Riparo Gaban: the Mesolithic layers. *Preistoria Alpina*, 36:3–42.

Kozlowski, S. K., Tozzi, C., Cremaschi, M., and Dini, M. (2003). L'industria di Isola Santa in Toscana e la sua posizione nel Sauveterriano italiano. *Rivista di Scienze Preistoriche*, LIII:193–239.

Lacam, R., Niederlender, A., and Valois, H.V. (1944). *Le gisement mésolithique du Cuzoul de Gramat*. Archives de l'Institut de paléontologie humaine, mémoire 21, 98 pages. Masson edition.

Langlais, M., Costamagno, S., Laroulandie, V., Pétillon, J.-M., Discamps, E., Mallye, J.-B., Cochard, D., and Kuntz, D. (2012). The evolution of Magdalenian societies in South-West France between 18,000 and 14,000 calBP: Changing environments, changing tool kits. *Quaternary International*, 272:138–149.

Langlais, M., Detrain, L., Ferrié, J.-G., Mallye, J.-B., Marquebielle, B., Rigaud, S., Turq, A., Bonnet-Jacquement, P., Boudadi-Maligne, M., Caux, S., Cheung, C. F., Naudinot, N., Morala, A., Valdeyron, N., and Chauvière, F.-X. (2014). Réévaluation des gisements de La Borie del Rey et de Port-de-Penne : nouvelles perspectives pour la transition Pléistocène-Holocène dans le Sud-Ouest de la France. In Langlais, M., Naudinot, N., and Marco Peresani, editors, *Les groupes culturels de la transition Pléistocène-Holocène entre Atlantique et Adriatique. Actes de la séance de la Société préhistorique française de Bordeaux, 24-25 mai 2012 (Séances de la Société préhistorique française, 3)*, pages 83–128.

Langlais, M., Laroulandie, V., Jacquier, J., Chalard, P., Mallye, J.-B., Pétillon, J.-M., Rigaud, S., Royer, A., Sitzia, L., Cochard, D., Fat Cheung, C., Le Gall, O., Queffelec, A., and Lacrampe-Cuyaubère, F. (2015). Le Laborien récent de la grotte-abri de Peyrazet (Creysse, Lot, France). Nouvelles données pour la fin du Tardiglaciaire en Quercy. *Paléo*, 26(2015):79–116.

Lanzinger, M. (1985). Ricerche nei siti mesolitici della Cresta di Siusi (Auf der Schneide, siti XV e XVI dell'Alpe di Siusi) nelle Dolomiti. Considerazioni sul significato funzionale espresso dalle industrie mesolitiche della regione. *Preistoria Alpina*, 21:33–48.

Laplace, G. (1964a). Essai de typologie systématique. volume I of *Nuova Serie*, pages 1–85. Università di Ferrara.

Laplace, G. (1964b). Les subdivision du leptolithique italien. *Bullettino di Paletnologia Italiana*, 73:25–63.

Le Brun-Ricalens, F. (2005). Chronique d'une reconnaissance attendue. Outils « carénés », outils « nucléiformes » : nucléus à lamelles. Bilan après un siècle de recherches typologiques, technologiques et tracéologiques. In Brun-Ricalens, F. L., Bordes, J.-G., and Bon, F., editors, *Productions lamellaires attribuées à l'Aurignacien : Chaînes opératoires et perspectives technoculturelles XIVe congrès de l'UISPP, Liège 2-8 Septembre 2001*, ArchéoLogiques 1, pages 23–72, Luxembourg.

Léa, V. (2005). Raw, pre-heated or ready to use: discovering specialist supply systems for flint industries in mid-Neolithic (Chassey culture) communities in southern France. *Antiquity*, 79:1–15.

Lemorini, C. (1994). Etude fonctionnelle des industries Mésolithiques de Lago delle Buse 1 et Lago delle Buse 2 (Lagorai, Trentino) par la méthode des traces d'utilisation. *Preistoria Alpina*, 28(1992):51–59.

Leroi-Gourhan, A. (1964). *Le Geste et la Parole*. Paris.

Ligabue, G. (1973). Grottina dei Covoloni del Broion (Vicenza). *Preistoria Alpina*, 9:264–263.

Ligabue, G. (1974). Grottina dei Covoloni del Broion (Lumignano di Longare, Prov. di Vicenza). *Rivista di Scienze Preistoriche*, XXIX(1):241–242.

Ligabue, G. (1975). Grottina dei Covoloni del Broion (Colli Berici, Prov. di Vicenza). *Rivista di Scienze Preistoriche*, XXX(1-2):366–367.

Ligabue, G. (1977). Grottina dei Covoloni del Broion (Prov. di Vicenza). *Rivista di Scienze Preistoriche*, XXXII(1-2):309.

Lo Vetro, D., Colonese, A. C., Mannino, M. A., Thomas, K. D., Di Giuseppe, Z., and Martini, F. (2016). The Mesolithic occupation at Isolidda (San Vito Lo Capo), Sicily. *Preistoria Alpina*, 48:237–243.

Lo Vetro, D. and Martini, F. (2012). Il Paleolitico e il Mesolitico in Sicilia. In *Atti XLI Riunione Scientifica IIPP, "Dai Ciclopi agli Ecisti: società e territorio nella Sicilia preistorica e protostorica". San Cipirello, Italy*, pages 19–48.

Lo Vetro, D. and Martini, F. (2016). Mesolithic in Central-Southern Italy: Overview of lithic productions. *Quaternary International*, 423:279–302.

Lombard, M. (2007). The gripping nature of ochre: The association of ochre with Howiesons Poort adhesives and Later Stone Age mastics from South Africa. *Journal of Human Evolution*, 53(4):406–419.

Lorblanchet, M. (1966). Sondage dans la grotte des Escabasses, commune de Thémines (Lot). *Bulletin de la Société préhistorique française*, 63(2):262–278.

Lunz, R. (1986). *Vor- und Frühgeschichte Südtirols: mit Ausblicken auf die Alpinen Nachbargebiete. Steinzeit. Bd. 1*. Manfrini R. Arti grafiche Vallagarina.

Maggi, R. and Negrino, F. (2016). The paradoxical pattern of the Mesolithic evidence in Liguria: piecing together the puzzle. *Preistoria Alpina*, 48:133–138.

Magi, M., Martini, F., Baglioni, L., and Nannini, L. (2008). Il Mesolitico di Levane-Bandella (Arezzo). L'insediamento sauveterriano del settore ovest. *Origini*, XXX:7–56.

Mannino, M. A., Catalano, G., Talamo, S., Mannino, G., Di Salvo, R., Schimmenti, V., Lalueza-Fox, C., Messina, A., Petruso, D., Caramelli, D., Richards, M. P., and Sineo, L. (2012). Origin and Diet of the Prehistoric Hunter-Gatherers on the Mediterranean Island of Favignana (Ègadi Islands, Sicily). *PLoS ONE*, 7(11):e49802.

Mansure-Franchomme, M. E. (1986). *Microscopie du matériel lithique préhistorique : traces d'utilisation, altérations naturelles, accidentelles et technologiques. Exemples de Patagonie*. Cahiers du Quaternaire, 9. CNRS edition.

Marchand, G. (2008). Dynamique des changements techniques sur les marges du Massif armoricain de l'Azilien au Premier Mésolithique. In *Le début du Mésolithique en Europe du Nord-Ouest : Actes de la table ronde d'Amiens, 9 et 10 octobre 2004*, pages 51–64.

Marchand, G. (2014). Premier et second Mésolithique : et au delà des techniques ? *P@lethnologie*, 6:9–22.

Marchand, G. and Perrin, T. (2017). Why this revolution? Explaining the major technical shift in Southwestern Europe during the 7th millennium cal. BC. *Quaternary International*, 428, Part B:73–85.

Marchesini, M., Marvelli, S., Gobbo, I., and Rizzoli, E. (2016). Paesaggio vegetale e ambiente nel sito mesolitico rinvenuto in localitá Le Mose (Piacenza , Nord Italia) ricostruito attraverso le indagini palinologiche e microantracologiche. *Preistoria Alpina*, 48:129–132.

Marquebielle, B. (2014). *Le travail des matières osseuses au Méolithique : Caractérisation technique et économique à partir des séries du sud et de l'est de la France*. Archaeology and prehistory, Université Toulouse le Mirail - Toulouse II.

Martin, H. and Le Gall, O. (1987). Le comportement des chasseurs mésolithiques de La Doue (Corrèze). Les indices fournis par la faune / Mesolithics hunting-strategies of La Doue (Corrèze). *Revue archéologique du Centre de la France*, 26(1):67–74.

Martini, F. (1993). *Grotta della Serratura a Marina di Camerota. Culture e ambienti dei complessi olocenici*. Garlatti e Razzai, Firenze.

Martini, F. (1999). *Sardegna paleolitica. Studi sul più antico popolamento dell'isola*. Millenni 1. Museo e Istituto Fiorentino di Preistoria, Firenze.

Martini, F. (2005). L'épipaléolithique indifférencié : caractères techno-typologiques d'un faciès mésolithique sans microlithes géométriques en Italie centro-méridionale. In Bracco, J.-P. and Montoya, C., editors, *D'un monde à l'autre. Les systèmes lithiques pendant le Tardiglaciaire autour de la Méditerranée nord-occidentale. Table Ronde internationale d'Aix-en-Provence, 6-8 juin 2001. Memoire XL de la Société préhistorique française*, pages 159–166.

Martini, F., editor (2007). *L'Italia tra 15.000 e 10.000 anni fa. Cosmopolitismo e regionalità nel Tardoglaciale. Atti della Tavola rotonda (Firenze, 18 novembre 2005)*. Studi di archeologia preistorica. Museo Fiorentino di Preistoria «Paolo Graziosi», Millenni.

Martini, F., Baglioni, L., Magri, F., Mazzucco, N., and Poggiani Keller, R. (2016a). Mesolithic frequentation at Cividate Camuno - Via Palazzo (Brescia - Italy). *Preistoria Alpina*, 48:93–101.

Martini, F., Lo Vetro, D., Brilli, P., Colonese, A., Di Giuseppe, Z., Forzisi, V., and Locatelli, E., Pedrolli, C., Sala, B., Tusa, S. (2012a). Dati preliminari sul Mesolitico di Grotta di Cala Mancina (S. Vito lo Capo, Trapani): Paletnologia e ambiente. In *Atti XLI Riunione Scientifica IIPP, "Dai Ciclopi agli Ecisti: società e territorio nella Sicilia preistorica e protostorica". San Cipirello, Italy*, pages 423–436.

Martini, F., Lo Vetro, D., Colonese, A., Cilli, C., De Curtis, O., Di Giuseppe, Z., Giglio, R., Locatelli, E., Sala, B., and Tusa, S. (2012b). Primi risultati sulle nuove ricerche stratigrafiche a Grotta d'Oriente (Favignana, Trapani). Scavi 2005. In *Atti XLI Riunione Scientifica IIPP, "Dai Ciclopi agli Ecisti: società e territorio nella Sicilia preistorica e protostorica". San Cipirello, Italy*, pages 319–332.

Martini, F., Lo Vetro, D., and Timpanelli, L. (2016b). New insight on the Romito shelter (Calabria, southern Italy): the lithic production of the Mesolithic levels. *Preistoria Alpina*, 48:231–236.

Martini, F., Lo Vetro, D., Timpanelli, L., Magri, F., and Poggiani Keller, R. (2016c). Mesolithic findings from the area of the engraved boulders at Cemmo (Lombardia, Italia). *Preistoria Alpina*, 48:89–92.

Martini, F. and Tozzi, C. (1996). Il Mesolitico in Italia centro-meridionale. In Kozłowski, S. K. and Tozzi, C., editors, *The Mesolithic, XIII Int. Congr. UISPP, Colloquium 7. Forlì, Italy*, pages 47–58.

Martini, F. and Tozzi, C. (2012). Il Mesolitico della Sardegna nel contesto insulare tirrenico. In *Atti XLIV Riunione scientifica IIPP "La preistoria e la protostoria della Sardegna", 2. Cagliari, Barumini, Sassari, Italy*, pages 399–406.

Martino, G. and Cremona, M. G. (2011). Solignano (PR) Progetto per la realizzazione di un nuovo fabbricato produttivo in località Rubbiano, tra via Vittorio Veneto – Via Galilei. Indagine archeologica realizzazione di saggi e splateamento dell'area. Technical report, GEA s.r.l. Ricerca e documentazione archeologica, Parma.

Maury, J. (1997). Les niveaux post-glaciaires dans l'Abri des Usclades (Nant, Aveyron). *Bulletin de la Société préhistorique française*, 94(4):509–526.

Maury, J. and Lacas, M. (1965). Un gisement sauveterrien sur les Grands Causses : L'abri des Salzets : Commune de Mostuéjouls (Aveyron). *Bulletin de la Société préhistorique française*, 62(2):67–70.

Mauss, M. (1947). *Manuel d'ethnographie*. Payot, Paris.

Mellars, P. A. (1981). Towards a Definition of the Mesolithic. *Mesolithic Miscellany*, 2(2):13–16.

Mercieca, A. (2000). Burnt and Broken: An Experimental Study of Heat Fracturing in Silcrete. *Australian Archaeology*, 51(5):40–47.

Mevel, L., Fornage-Bontemps, S., and Béreiziat, G. (2014). Au carrefour des influences culturelles ? Les industries lithiques de la fin du Tardiglaciaire entre Alpes du Nord et Jura, 13500-9500 cal. BP. In Langlais, M., Naudinot, N., and Peresani, M., editors, *Les groupes culturels de la transition Pléistocène-Holocène entre Atlantique et Adriatique. Actes de la séance de la Société préhistorique française de Bordeaux, 24-25 mai 2012.*, pages 45–81, Paris. Société préhistorique française.

Mezzena, F. and Perrini, L. (2002). Mont Fallère. Des trouvailles mésolithiques au Val d'Aoste. In *Premiers hommes dans les Alpes, de 50000 à 5000 avant Jésus-Christ*, pages 187–188. Sion, Lausanne.

Michel, S. (2007). Les « territoires » stylistiques du premier Mésolithique en Poitou-Charentes et Pays-de-la-Loire1. *Revue archéologique de l'Ouest*, 24:7–30.

Michel, S. (2009). Le Premier Mésolithique du Centre-Ouest : modalités techniques de l'industrie lithique. *Bulletin de la Société préhistorique française*, 106(4):715–734.

Michel, S. (2011). *Les premiers groupes mésolithiques de la France atlantique : enquête sur l'industrie lithique*. Thèse de doctorat, Université de Rennes 1.

Miras, Y., Guenet, P., and Richard, H. (2011). Holocene vegetation, landscape and reconstruction of human activity from prehistory to the Roman period based on New pollen data performed in "the plateau de Millevaches" (Limousin, Massif central, France). *Quaternaire*, 22(2):147–164.

Monin, G. and Pelletier, D. (2000). Note sur les industries mésolithiques et néolithique ancien de l'abri des Balmettes (St Aupre, Isère), et proposition de chronologie du Mésolithique ancien et de la fin de l'Épipaléolithique au Préboréal entre Alpes françaises du Nord et Jura méridional. In Tillet, T., editor, *Les Paléoalpins : hommage à Pierre Bintz*, pages 129–141. Université Joseph Fourier, Grenoble, géologie a edition.

Montoya, C. (2004). *Les traditions techniques lithiques à l'Épigravettien: Analyses de séries du Tardiglaciaire entre Alpes et Méditerranée*. Thèse de doctorat, Université Aix-Marseille I.

Montoya, C., Balasescu, A., Joannin, S., Ollivier, V., Liagre, J., Nahapetyan, S., Ghukasyan, R., Colonge, D., Gasparyan, B., and Chataigner, C. (2013). The Upper Palaeolithic site of Kalavan 1 (Armenia): An Epigravettian settlement in the Lesser Caucasus. *Journal of Human Evolution*, 65(5):621–640.

Moroni, A., Boscato, P., Allevato, E., Benocci, A., Di Bella, F., Di Pasquale, G., Favilli, L., Manganelli, G., and Gambassini, P. (2016). The Mesolithic occupation at Grotta della Cala (Marina di Camerota - Salerno - Italy). A preliminary assessment. *Preistoria Alpina*, 48:171–182.

Moss, E.-H. (1983). *The functional analysis of flint implements. Pincevent and Pont-d'Ambon, two case studies from the french final Paleolithic*. BAR International Series 177. Oxford.

Mourre, V., Villa, P., and Henshilwood, C. (2010). Early use of pressure flaking on lithic artifacts at Blombos Cave. *Science*, 330(6004):659–662.

Mozzi, P. (2005). Alluvial plain formation during the Late Quaternary between the Southern Alpine margin and the Lagoon of Venice (Northern Italy). *Geografia Fisica e Dinamica Quaternaria*, VII:219–229.

Mussi, M., Cancellieri, E., D'Angelo, E., Fiore, I., Melis, R. T., Russ, H., and Salvadei, L. (2011). Ricerche a Grotta di Pozzo (AQ): 1992-2009. In *Il Fucino e le aree limitrofe nell'antichità. Atti del III Convegno di Archeologia in ricordo di Walter Cianciusi. Castello Orsini, Avezzano, 13-15 novembre 2009*, pages 13–15.

Mussi, M. and Peresani, M. (2011). Human settlement of Italy during the Younger Dryas. *Quaternary International*, 242(2):360–370.

Naudinot, N., Tomasso, A., Tozzi, C., and Peresani, M. (2014). Changes in mobility patterns as a factor of 14C date density variation in the Late Epigravettian of Northern Italy and Southeastern France. *Journal of Archaeological Science*, 52:578–590.

Newell, R. and Constandse-Westermann, T. (2015). Population growth, density and technology in the Western European Mesolithic: Lessons from analogous historical contexts. *Palaeohistoria*, 26:1–18.

Onoratini, G. (1982). Un site montadien de plein air à Senas (Bouches-du-Rhône). *Bulletin de la Société préhistorique française*, 79(2):46–50.

Paccard, M., Livache, M., and Dumas, C. (1968). Note préliminaire sur le camp mésolithique de Gramari, commune de Méthamis (Vaucluse). *Bulletin de la Société préhistorique française*, 65(1):327–334.

Palavanchi, S. (2008). *L'occupazione sauveterriana dell'area di Le Mose (Piacenza). Il contributo dello studio tecno-tipologico delle industrie litiche*. Tesi di laurea specialistica, Università degli Studi di Ferrara.

Palma di Cesnola, A. (1983). L'épigravettien évolué et final de la région haute-tyrrhénienne. In *Actes du colloque international "La position taxonomique et chronologique des industries à pointes à dos autour de la méditerranée européenne", Siena 3–6 novembre 1983*, pages 301–318.

Palma di Cesnola, A., Bietti, A., and Galiberti, A. (1985). L'Epigravettien évolué et final dans les Pouilles. *Rivista di Scienze Preistoriche*, XXXVIII(1-2):267–300.

Pellegrini, G. B., Surian, N., Albanese, D., Degli Alessandrini, A., and Zambrano, R. (2006). Le grandi frane pleistoceniche di Marziai e dei Collesei di Anzù e loro effetti sull'evoluzione geomorfologica e paleoidrografica della Valle del Piave nel Canale di Quero (Prealpi Venete). *Studi Trent. Sci. Nat., Acta Geologica*, 81(2004):87–104.

Perales Barrón, U. (2015). *Traceología de la industria lítica de Atxoste (Alava): Aproximación a la gestión económico-social del asentamiento en el final del mesolítico e inicios del neolítico*. Tesis doctoral, Universidad del Pais Vasco.

Peresani, M. (2009). Le frequentazioni del Cansiglio nel quadro del popolamento preistorico delle Alpi Italiane Orientali. In Peresani, M. and Ravazzi, C., editors, *Le Foreste dei Cacciatori Paleolitici. Ambiente e popolamento umano in Cansiglio tra Tardoglaciale e Postglaciale*, Supplemento al Bollettino della Società Naturalisti Silvia Zenari, pages 121–144, Pordenone.

Peresani, M. and Angelini, A. (2002). Il sito mesolitico di Casera Davià II sull'Altopiano del Cansiglio (Prealpi Venete). *Rivista di Scienze Preistoriche*, LII:197–230.

Peresani, M., Astuti, P., Di Anastasio, G., Di Taranto, E., Duches, R., Masin, I., and Miolo, R. (2011). Gli insediamenti epigravettiani e la frequentazione mesolitica attorno al Palughetto sull'Altopiano del Cansiglio (Prealpi Venete). *Preistoria Alpina*, 45:21–65.

Peresani, M. and Bertola, S. (2010). Approvisionnement en matériaux siliceux et économie du débitage dans le Sauveterrien : l'exemple du haut-plateau du Cansiglio (Alpes orientales italiennes). *Préhistoires Méditerranéennes*, 1:87–99.

Peresani, M., Di Anastasio, G., and Bertola, S. (2000). Epigravettien récent et Mésolithique ancien en contexte préalpin: les données du haut plateau du Cansiglio (Italie du Nord). *Actes de la Table ronde "Epipaléolithique et Mésolithique". Lausanne, 21-23 novembre 1997*, pages 267–276.

Peresani, M., Ferrari, S., Miolo, R., and Ziggiotti, S. (2009). Il sito di Casera Lissandri 17 e l'occupazione sauveterriana del versante occidentale di Piancansiglio. In Peresani, M. and Ravazzi, C., editors, *Le foreste dei cacciatori paleolitici. Ambiente e popolamento umano in Cansiglio tra Tardoglaciale e Postglaciale*, Supplemento al Bollettino della Società Naturalisti Silvia Zenari, pages 199–227, Pordenone.

Peresani, M., Ferrari, S., and Ziggiotti, S. (2007). Primi dati sul sito di Casera Lissandri 17 (Altopiano del Cansiglio) e sull'industria mesolitica in selce e cristallo di rocca. *Quaderni di Archeologia del Veneto*, XXIII:15–19.

Peresani, M. and Miolo, R. (2011). Small shifts in handedness bias during the Early Mesolithic? A reconstruction inferred from Microburin technology in the eastern Italian Alps. *Journal of Anthropological Archaeology*.

Peresani, M., Ziggioitti, S., and Dalmeri, G. (2002). Truncations and pseudo-truncations in the Recent Epigravettian industries of North-Eastern Italy. *Preistoria Alpina*, 38:67–88.

Perrin, T. (2001). *Évolution du silex taillé dans le Néolithique haut-rhodanien autour de la stratigraphie du Gardon (Ambérieu-en-Bugey, Ain)*. Thése de doctorat, Université Panthéon-Sorbonne - Paris I.

Perrin, T. (2006). Nouvelles réflexions sur la transition Mésolithique récent–Néolithique ancien à l'abri Gaban (Trento, Italie). *Preistoria Alpina*, 41(2005):89–146.

Perrin, T. and Defranould, E. (2016). The Montclus rock shelter (Gard) and the continuity hypothesis between 1st and 2nd Mesolithic in Southern France. *Quaternary International*, 423:230–241.

Perrin, T., Marchand, G., Allard, P., Binder, D., Carmine, C., Garcia-Puchol, O., and Valdeyron, N. (2009). Le second Mésolithique d'Europe occidentale : origines et gradient chronologique. *Annales de la Fondation Fyssen*, 24:160–177.

Pétillon, J.-M., Bignon, O., Bodu, P., Cattelain, P., Debout, G., Langlais, M., Laroulandie, V., Plisson, H., and Valentin, B. (2011). Hard core and cutting edge: experimental manufacture and use of Magdalenian composite projectile tips. *Journal of Archaeological Science*, 38:1266–1283.

Pétillon, J.-M., Laroulandie, V., Costamagno, S., and Langlais, M. (2016). Testing environmental determinants in the cultural evolution of hunter-gatherers: a three-year multidisciplinary project on the occupation of the western Aquitaine basin during the Middle and Upper Magdalenian (19–14 kyr cal BP). *Quaternary International*, 414:1–8.

Philibert, S. (1991). Analyse tracéologique de l'industrie lithique et approche fonctionelle du site. In *Fontfaurès en Quercy. Contribution à l'étude du Sauveterrien*, pages 151–169. Centre d'Anthropologie des Sociétés Rurales, Toulouse, archives d edition.

Philibert, S. (2002). *Les derniers" Sauvages": territoires économiques et systèmes techno-fonctionnels mésolithiques*. Archaeopress, Oxford, bar intern edition.

Philibert, S. (2016). Ist vs. IInd Mesolithic in southern France. Functional approach of techno-economic behavior through the Castelnovian of Montclus rock shelter (Gard): First results. *Quaternary International*, 423:242–251.

Picavet, R., Angelin, A., and Moulin, B. (2014). *Massif du Vercors : état des prospections sur les Hauts-Plateaux et les Quatre Montagnes pendant la Préhistoire récente*. Number 20.

Pignat, G. and Plisson, H. (2000). Le quartz,pou quel usage? L'outillage mésolithique de Vionnaz (CH) et l'apport de la tracéologie. In Crotti, P., editor, *Actes de la table ronde "Épipaleolithique et Mesolithiqe" Laussane, 21-23 novembre, 1997. Cahiers d'archéologie romande, 81*, pages 65–78, Lausanne.

Pion, G. and Thévenin, A. (2007). Le Mésolithique de l'abri de la Fru à Saint-Christophe-la-Grotte (Savoie). *Bulletin de la Société préhistorique française*, 104(3):483–515.

Plisson, H. (1985). *Etude fonctionnelle d' outillages Iithiques prehistoriques par I'analyse des micro-usures: recherche methodologique et archeologique*. Thèse, Universitée de Paris I Pantheon Sorbonne.

Plisson, H. (2006). Un burin ne sert pas à buriner mais en burinant. *ArchéoLogiques*, 2(Burins préhistoriques : formes, fonctionnements, fonctions):23–33.

Plisson, H., Dubreuil, L., and Guilbert, R. (2008). The functional significance of Sauveterrian microlithic assemblages: broadening the focus of investigation. In Longo, L. and Skakun, N., editors, *"Prehistoric technology" 40 years later : functional studies and the Russian legacy*, BAR, pages 147–156.

Porraz, G., Parkington, J. E., Rigaud, J. P., Miller, C. E., Poggenpoel, C., Tribolo, C., Archer, W., Cartwright, C. R., Charrié-Duhaut, A., Dayet, L., Igreja, M., Mercier, N., Schmidt, P., Verna, C., and Texier, P. J. (2013). The MSA sequence of Diepkloof and the history of southern African Late Pleistocene populations. *Journal of Archaeological Science*, 40(9):3542–3552.

Price, T., Chappell, S., and Ives, D. (1982). Thermal alteration in Mesolithic assemblages. *Proceedings of the Prehistoric Society*, 48:467–485.

Radmilli, A. (1982). Piazzana (Coreglia Antelminelli, Prov. di Lucca). *Rivista di Scienze Preistoriche*, 37(1-2):306.

Raiteri, L. V. M. (2013). *Popolamento umano ed evoluzione del paesaggio alle pendici del Mont Fallère (Saint-Pierre, Valle d'Aosta) nell'Olocene Antico e Medio*. PhD thesis, Università degli Studi di Ferrara.

Ravazzi, C., Peresani, M., Pini, R., and Vescovi, E. (2007). Il Tardoglaciale nelle Alpi Italiane e in Pianura Padana. Evoluzione stratigrafica, storia della vegetazione e del popolamento antropico. *Il Quaternario. Italian Journal of Quaternary Sciences*, 20(2):163–184.

Ravazzi, C. and Vescovi, E. (2009). Le testimonianze fossili della riforestazione del Cansiglio al termine dell'ultima glaciazione. In Peresani, M. and Ravazzi, C., editors, *Le foreste dei cacciatori paleolitici. Ambiente e popolamento umano in Cansiglio tra Tardoglaciale e Postglaciale*, Supplemento al Bollettino della Società Naturalisti Silvia Zenari, pages 65–96, Pordenone.

Reille, M. and Andrieu, V. (1995). The late Pleistocene and Holocene in the Lourdes Basin, Western Pyrenees, France: new pollen analytical and chronological data. *Vegetation History and Archaeobotany*, 4(1):1–21.

Reimer, P. J., Bard, E., Bayliss, A., Beck, J. W., Blackwell, P. G., Bronk Ramsey, C., Buck, C. E., Cheng, H., Edwards, R. L., Friedrich, M., Grootes, P. M., Guilderson, T. P., Haflidason, H., Hajdas, I., Hatté, C., Heaton, T. J., Hoffmann, D. L., Hogg, A. G., Hughen, K. A., Kaiser, K. F., Kromer, B., Manning, S. W., Niu, M., Reimer, R. W., Richards, D. A., Scott, E. M., Southon, J. R., Staff, R. A., Turney, C. S. M., and van der Plicht, J. (2013). IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0–50,000 Years cal BP. *Radiocarbon*, 55(4):1869–1887.

Riede, F. (2009). Climate and Demography in Early Prehistory: Using Calibrated 14C Dates as Population Proxies. *Human Biology. Special Issue on Demography and Cultural Macroevolution*, 81(11).

Riede, F., Edinborough, K., and Thomas, M. (2009). Tracking Mesolithic Demography in Time and Space and its Implications for Explanations of Culture Change. In Crombé, P., Van Strydonck, M., Sergant, J., Boudin, M., and Bats, M., editors, *Chronology and Evolution within the Mesolithic of North-West Europe: Proceedings of an International Meeting, Brussels, May 30th-June 1st 2007*, pages 177–194, Newcastle. Cambridge Scholars Publishing.

Roman, D. (2010). *El poblament del final del Plistocè en les comarques del nord del País Valencià a partir de l'estudi tecno-tipològic de la indústria lítica*. Tesis doctoral, Universitat de València.

Roman, D. (2015). La tecnología lítica durante el Magdaleniense en la vertiente Mediterránea de la península Ibérica. *Journal of Lithic Studies*, 2(2).

Roque-Rosell, J., Torchy, L., Roucau, C., Leá, V., Colomban, P., Regert, M., Binder, D., Pelegrin, J., Sciau, P., Vandiver, P. B., Li, W., Ruvalcaba Sil, J. L., Reedy, C. L., and Frame, L. D. (2011). Influence of heat treatment on the physical transformations of flint used by Neolithic societies in the western Mediterranean. *Materials issues in art and archaeology IX: symposium held November 29-December 3, Boston, Massachusetts, USA*, (March):81–88.

Rots, V. (2010). *Prehension and HaftingWear on Flint Tools. A Methodology*. Leuven University Press, Leuven.

Rots, V. and Plisson, H. (2014). Projectiles and the abuse of the use-wear method in a search for impact. *Journal of Archaeological Science*, 48:154–165.

Roussot-Larroque, J. (2009). Les complexes géométriques en Aquitaine. In Utrilla Miranda, P. and Ramirez Sanchez, L., editors, *El Mesolítico Geométrico en la Península Ibérica, Actes du colloque de Jaca (2008). Monographías Arquelógicas, 44*, pages 279–306, Zaragoza.

Rozoy, J.-G. (1968). Typologie de l'Épipaléolithique (Mésolithique) franco-belge. *Bulletin de la Société préhistorique française. Études et travaux*, 65(1):335–364.

Rozoy, J.-G. (1978). *Les derniers chasseurs. L'Epipaléolithique en France et en Belgique. Essai de synthèse.* Bulletin de la société archéologique champenoise, numéro special.

Schäfer, D., editor (2011). *Das Mesolithikum-Projekt Ullafelsen (Teil 1)*. Mensch und Umwelt im Holozän Tirols Band 1. Innsbruck, Philipp von Zabern GmbH.

Schäfer, D., Bertola, S., Pawlik, A., Geitner, C., Waroszewski, J., and Bussemer, S. (2016). The landscape-archaeological Ullafelsen Project (Tyrol, Austria) Dieter. *Preistoria Alpina*, 48:33–41.

Schmidt, P., Léa, V., Sciau, P., and Fröhlich, F. (2013a). Detecting and quantifying heat treatment of flint and other silica rocks: A new non-destructive method applied to heat-treated flint from the neolithic chassey culture, Southern France. *Archaeometry*, 55(5):794–805.

Schmidt, P., Paris, C., and Bellot-Gurlet, L. (2016). The investment in time needed for heat treatment of flint and chert. *Archaeological and Anthropological Sciences*, 8(4):839–848.

Schmidt, P., Porraz, G., Slodczyk, A., Bellot-gurlet, L., Archer, W., and Miller, C. E. (2013b). Heat treatment in the South African Middle Stone Age: Temperature induced transformations of silcrete and their technological implications. *Journal of Archaeological Science*, 40(9):3519–3531.

Schmidt, P., Slodczyk, A., Léa, V., Davidson, A., Puaud, S., and Sciau, P. (2013c). A comparative study of the thermal behaviour of length-fast chalcedony, length-slow chalcedony (quartzine) and moganite. *Physics and Chemistry of Minerals*, 40(4):331–340.

Séara, F. (2000a). Deux types d'organisation spatiale de campements mésolithiques : les cas de Choisey « Aux Champins » et de Ruffey-sur-Seille « A Daupharde » , dans le Jura. In Cupillard, C. and Richard, A., editors, *Les derniers chasseurs cueilleurs d'Europe occidentale, actes du colloque international de Besançon, Octobre 1998*, pages 209–219, Besançon. Presses Universitaires Franc-Comtoises.

Séara, F. (2000b). Les cadres chronologiques des occupations mésolithiques de Ruffey-sur-Seille «À Daupharde» et de Choisey «Aux Champins» (Jura). In *Les derniers chasseurs cueilleurs d'Europe occidentale, actes du colloque international de Besançon, Octobre 1998*, pages 125–132, Besançon. Presses Universitaires Franc-Comtoises.

Séara, F. (2014). Variabilité des schémas de production lithique : facteurs et signification. *P@lethnologie*, 6:23–53.

Séara, F. and Roncin, O. (2013). Mesolithic valley flor occupations: The case of Dammartin-Marpain in the Jura. In Valentin, B., Souffi, B., Ducrocq, T., Fagnart, J.-P., Séara, F., and Verjux, C., editors, *Mesolithic Palethnography. Research on open-air sites between Loire and Neckar. Proceedings from the international round-table meeting, Paris, November 26–27, 2010 (Séances de la Société préhistorique française 2-2)*, pages 93–115, Paris. Société préhistorique française.

Semenov, S. (1964). *Prehistoric Technology: An Experimental Study of the Oldest Tools and Artefacts from Traces of Manufacture and Wear*. Adams & Dart.

Séronie-Vivien, M.-R. (2001). *La grotte du Sanglier à Reilhac (Lot). Du Magdalénien au Néolithique ancien*. Préhistoire du Sud-Ouest, Supplément 4.

Soto Sebastián, A. (2014). *Producción y gestión de la industria lítica de Atxoste (Álava): una aproximaciòn a las sociedades epipaleolìticas y mesoliticas del Alto Ebro*. Tesis doctoral, Universidad del Pais Vasco.

Soto Sebastián, A., Alday, A., Montes, L., Utrilla, P., Perales, U., and Domingo, R. (2015). Epipalaeolithic assemblages in the Western Ebro Basin (Spain): The difficult identification of cultural entities. *Quaternary International*, 364:144–152.

Souffi, B., Marti, F., Chaussé, C., Bridault, A., David, É., Drucker, D., Gosselin, R., Granai, S., Griselin, S., Leduc, C., Valentin, F., and Vanhaeren, M. (2013). Mesolithic occupations on the edge of the Seine. Spatial organisation and function of the site of 62 rue Henry-Farman, Paris (15th arrondissement) Bénédicte. In Valentin, B., Souffi, B., Ducrocq, T., Fagnart, J.-P., Séara, F., and Verjux, C., editors, *Mesolithic Palethnography. Research on open-air sites between Loire and Neckar. Proceedings from the international round-table meeting, Paris, November 26–27, 2010 (Séances de la Société préhistorique française 2-2)*, pages 13–36, Paris. Société préhistorique française.

Stiner, M. C., Munro, N. D., and Surovell, T. A. (2000). The Tortoise and the Hare. Small-Game Use, the Broad- Spectrum Revolution, and Paleolithic Demography. *Current Anthropology*, 41(1):39–73.

Stiner, M. C., Munro, N. D., Surovell, T. A., Tchernov, E., and Bar-Yosef, O. (1999). Paleolithic Population Growth Pulses Evidenced by Small Animal Exploitation. *Science*, 283(5399):190–194.

Tagliacozzo, A., Fiore, I., Lo Vetro, D., Calcagnile, L., and Tiné, V. (2016). The Mesolithic levels of Grotta del Santuario della Madonna at Praia a Mare (Cosenza, Ital): new excavations , chronological data and techno-typological features of the lithic assemblages. *Preistoria Alpina*, 48:183–197.

Tallet, P., Chesnaux, L., Fernandes, P., Rué, M., and Taylor, A. (2013). Le complexe de sites de Saint-Lizier à Creysse. Rapport Final d'Opération. Paleotime. Technical report.

Taschini, M. (1964). Il livello mesolitico del Riparo Blanc al Monte Circeo. *Bullettino di Paletnologia Italiana*, 73:65–88.

Taschini, M. (1968). Le datation au C14 de l'Abri Blanc (Mont Circé). Quelques observation sur le Mésolithique en Italie. *Quaternaria*, X:137–167.

Taute, W. (1974). Neue forschungen zur chronologie von Spätpaläolithikum und Mesolithikum in Süddeutschland. *Archäologische Informationen*, 2-3:59–66.

Thévenin, A. (1996). Le Mésolithique de la France dans le cadre du peuplement de l'Europe occidentale. In Kozlowski, S. K. and Tozzi, C., editors, *The Mesolithic. Colloquium XIII Formation of the European Mesolithic Complexes. XIII International Congress of Prehistoric and Protostoric Sciences*, pages 17–32.

Thévenin, A. (1999). L'Epipaléolithique et le Mésolithique en France et régions voisines. In Thévenin, A., editor, *L'Europe des derniers chasseurs, 5e Colloque international UISPP, 18-23 septembre 1995*, pages 17–24.

Thun Hohenstein, U., Bertolini, M., Valverde, I., Dalmeri, G., and Pedrotti, A. (2016a). Exploitation of faunal resources at Riparo Gaban (Trento, Italy) during the Late Mesolithic period: preliminary results of archaeozoological and taphonomical analysis. *Preistoria Alpina*, 48:53–62.

Thun Hohenstein, U., Turrini, M. C., Guerreschi, A., and Fontana, F. (2016b). Red deer vs. ibex hunting at a seasonal base camp in the Dolomites: Mondeval de Sora, site 1, sector I. *Quaternary International*, 423:92–101.

Tixier, J. and Inizan, M.-L. (2000). L'émergence des arts du feu : le traitement thermique des roches siliceuses. *Paléorient*, 26:23–36.

Tomàskovà, S. (2005). What is a Burin? Typology, Technology, and Interregional Comparison. *Journal of Archaeological Method and Theory*, 12(2):79–115.

Tomasso, A. (2015). Se déplacer moins ou se déplacer autrement ? Mutations des systèmes de mobilité et des stratégies d'approvisionnement à la fin du Paléolithique supérieur en Provence et en Italie. In Naudinot, N., Meignen, L., Binder, D., and Querré, G., editors, *Les systèmes de mobilité de la Préhistoire au Moyen Âge. XXXVe rencontres internationales d'archéologie et d'histoire d'Antibes*, pages 223–240, Antibes. Éditions APDCA.

Tomasso, A., Naudinot, N., Binder, D., and Grimaldi, S. (2014). Unité et diversité dans l'Épigravettien récent de l'arc liguro-provençal. In Langlais, M., Naudinot, N., and Peresani, M., editors, *Les groupes culturels de la transition Pléistocène-Holocène entre Atlantique et Adriatique. Séances de la société préhistorique française, 3*, pages 155–184, Paris.

Tozzi, C. and Dini, M. (2007). L'epigravettiano finale nell'alto versante tirrenico: casi studio dell'area Toscana. In Martini, F., editor, *L'Italia tra 15.000 e 10.000 anni fa. Cosmopolitismo e regionalità nel Tardoglaciale. Atti della Tavola rotonda (Firenze, 18 novembre 2005)*, pages 95–129.

Tringham, R., Cooper, G., Odell, G., Voytek, B., and Whitman, A. (1974). Experimentation in the Formation of Edge Damage: A New Approach to Lithic Analysis. *Journal of Field Archaeology*, 1(1-2):171–196.

Vai, S., Vilaça, S. T., Romandini, M., Benazzo, A., Visentini, P., Modolo, M., Bertolini, M., MacQueen, P., Austin, J., Cooper, A., Caramelli, D., Lari, M., and Bertorelle, G. (2015). The Biarzo case in northern Italy: is the temporal dynamic of swine mitochondrial DNA lineages in Europe related to domestication? *Scientific Reports*, 5(16514):1–9.

Valdeyron, N. (1994). *Le Sauveterrien. Culture et sociétés mésolithiques dans la France du Sud durant les X et IX millénaires B.P.* Thèse de doctorat nouveau régime, Université Toulouse-Le Mirail.

Valdeyron, N. (2000). Le gisement de la grotte des Escabasses à Thémines (Lot) et la séquence mésolithique en Aquitaine. In *Les derniers chasseurs cueilleurs d'Europe occidentale. Actes du colloque international de Besançon, Octobre 1998*, pages 151–159, Besançon.

Valdeyron, N. (2008a). Sauveterrien et Sauveterriano : unité ou diversité du premier mésolithique en France méridionale et en Italie du nord. *Pallas*, pages 247–259.

Valdeyron, N. (2008b). The Mesolithic in France. In Bailey, G. and Spikins, P., editors, *Mesolithic Europe*, chapter 7, pages 182–202. Cambridge University Press, Cambridge.

Valdeyron, N., Bosc-Zanardo, B., and Briand, T. (2008). Évolutions des armatures de pierre et dynamiques culturelles durant le mésolithique dans le sud-ouest de la france : l' exemple du haut quercy (lot, france). In J.-M. Pétillon, Dias-Meirinho, M.-H., Cattelain, P., Honegger, M., Normand, C., and Valdeyron, N., editors, *Recherches sur les armatures de projectiles du Paléolithique supérieur au néolithique (actes du colloque C83, XVe septembre 2006)*, P@lethnologie, 1, pages 278–295.

Valdeyron, N., Briand, T., Bouby, L., Henry, A., Khedhaier, R., Marquebielle, B., Martin, H., Thibeau, A., and Bosc-Zanardo, B. (2011). Le gisement mésolithique des Fieux (Miers, Lot) : une halte de chasse sur le causse de Gramat ? In Bon, F., Costamagno, S., and Valdeyron, N., editors, *Haltes de chasse en Préhistoire. Quelles réalités archéologiques ?, Actes du colloque international du 13 au 15 mai 2009, Université Toulouse II - Le Mirail*, P@lethnologie, 3, pages 335–346.

Valdeyron, N., Henry, A., Marquebielle, B., Bosc-Zanardo, B., Gassin, B., Michel, S., and Philibert, S. (2014). Le Cuzoul De Gramat (Lot, France): A key sequence for the early Holocene in southwest France. In Foulds, F. W. F., Drinkall, H. C., Perri, A. R., Clinnick, D. T. G., and Walker, J. W. P., editors, *Wild Things. Recent Advances in Palaeolithic and Mesolithic Research*, number December. Oxbow Books.

Valentin, B. (2006). *De l'Oise à la Vienne, en passant par le Jourdain. Jalons pour une paléohistoire des derniers chasseurs*. PhD thesis, Université Paris I.

Valentin, B. (2008). Typologie vs Technologie (sic!). Comment la technologie contribue a raffiner la typologie des armatures lithiques. In *Space and Time: which diachronies, which synchronies, which scales? Typology vs Technology. (XVI Congreso UISPP , Lisboa, 2006)*, BAR International Series 1831, pages 189–196.

Valletta, F., Fontana, F., Bertola, S., and Guerreschi, A. (2016). The Mesolithic lithic assemblage of site VF1-sector III of Mondeval de Sora (Belluno, Italy). Economy, technology and typology. *Preistoria Alpina*, 48:73–81.

Valloni, R. and Baio, M. (2008). Sedimentazione altoquaternaria nel tratto emiliano del tracciato Alta Velocità. In Bernabò Brea, M. and Valloni, R., editors, *Archeologia ad Alta Velocità in Emilia. Indagini geologiche e archeologiche lungo il tracciato ferroviario. Atti del Convegno, 9 giugno 2003, Parma, Quaderni di Archeologia dell'Emilia Romagna, vol. 22*, pages 21–39. All'insegna del Giglio, Firenze.

Van Gijn, A. L. (1989). *The wear and tear of flint. Principles of functional analysis applied to Dutch Neolithic assemblages*. Analecta Praehistorica Leidensia 22.

Van Gijn, A. L. (2010). *Flint in Focus. Lithic Biographies in the Neolithic and Bronze Age*. Sidestone Press, Leiden, 289 pages.

Van Gijn, A. L. (2014). Science and interpretation in microwear studies. *Journal of Archaeological Science*, 48:166–169.

Vaquer, J. and Ruas, M.-P. (2009). La grotte de l'Abeurador Félines-Minervois (Hérault) : occupations humaines et environnement du Tardiglaciaire à l'Holocène. In *De Méditerranée et d'ailleurs. . . Mélanges offerts à Jean Guilaine*, pages 761–792. Archives d'Écologie Préhistorique, Toulouse.

Vaughan, P. (1981). *Lithic Microwear Experimentation and functional analysis of a Lower Magdalenian Stone Tool Assemblage*. Ph.d. dissertation, University of Pennsylvania.

Verjux, C., Souffi, B., Roncin, O., Lang, L., Kildéa, F., Deschamps, S., and Chamaux, G. (2013). The Mesolithic of the Centre Region: state of research. In Valentin, B., Souffi, B., Ducrocq, T., Fagnart, J.-P., Séara, F., and Verjux, C., editors, *Mesolithic Palethnography. Research on open-air sites between Loire and Neckar. Proceedings from the international round-table meeting, Paris, November 26–27, 2010 (Séances de la Société préhistorique française 2-2)*, pages 69–91, Paris. Société préhistorique française.

Vermeersch, P. M. (2008). La transition Ahrensbourgien-Mésolithique ancien en Campine belge et dans le sud sableux des Pays-Bas. *Le début du Mésolithique en Europe du Nord-Ouest*, Mémoire XL:11–30.

Vescovi, E., Ravazzi, C., Arpenti, E., Finsinger, W., Pini, R., Valsecchi, V., Wick, L., Ammann, B., and Tinner, W. (2007). Interactions between climate and vegetation during the Lateglacial period as recorded by lake and mire sediment archives in Northern Italy and Southern Switzerland. *Quaternary Science Reviews*, 26(11-12):1650–1669.

Visentin, D. (2011). *Il sito mesolitico di Collecchio (PR) nel quadro del primo popolamento antico olocenico dell'area emiliana.* PhD thesis, Università degli Studi di Ferrara.

Visentin, D. (2014). La scheggiatura del quarzo: risultati del programma sperimentale. Rapporto Tecnico. Technical report, R.A.V.A., Assessorato Istruzione e Cultura, Soprintendenza per i beni e le attività culturali, Direzione restauro e valorizzazione, Ufficio beni archeologici.

Visentin, D., Angelucci, D. E., Berruti, G. L. F., Bertola, S., Leis, M., Marchesini, M., Marvelli, S., Pezzi, M., Rizzoli, E., Hohenstein, U. T., and Fontana, F. (2016a). First evidence of human peopling in the southern Po plain after the LGM: the early Sauveterrian site of Collecchio (Parma, Northern Italy). *Preistoria Alpina*, 48:115–128.

Visentin, D., Bertola, S., Ziggiotti, S., and Peresani, M. (2016b). Going off the beaten path? The Casera Lissandri 17 site and the role of the Cansiglio plateau on human ecology during the Early Sauveterrian in North-eastern Italy. *Quaternary International*, 423:213–229.

Visentin, D., Carrer, F., Fontana, F., Cavulli, F., Cesco Frare, P., Mondini, C., and Pedrotti, A. (2016c). Prehistoric landscapes of the Dolomites: Survey data from the highland territory of Cadore (Belluno Dolomites, Northern Italy). *Quaternary International*, 402:5–14.

Visentin, D. and Fontana, F. (2016). An intra-site perspective on the Sauveterrian lowland occupation of the Emilian Po plain (Northern Italy). *Quaternary International*, 423:58–72.

Visentin, D., Fontana, F., and Bertola, S. (2014). An atypical early Mesolithic occupation in the Southern Po Plain: evidence from the site of Collecchio (Parma, Italy). *P@lethnologie*, 6:124–129.

Visentin, D., Fontana, F., Cavulli, F., Carrer, F., Mondini, C., Cesco Frare, P., and Pedrotti, A. (2016d). The "Total Archaeology Project" and the Mesolithic occupation of the highland district of San Vito di Cadore. *Preistoria Alpina*, 48:63–68.

Visentin, D., Philibert, S., and Valdeyron, N. (in press). Couteaux de Rouffignac: A new insight into an old tool. In *MESO2015 Proceedings*.

Wadley, L. (2005). Putting ochre to the test: Replication studies of adhesives that may have been used for hafting tools in the Middle Stone Age. *Journal of Human Evolution*, 49(5):587–601.

Walczak, J. (1998). La question des styles techniques durant le Mésolithique : remarques générales sur le style tardenoisien de Coincy et sur sa"valeur humaine". *Bulletin de la Société préhistorique française*, 95(2):203–220.

Wierer, U. (2007). Studio tipologico dell'industria sauveterriana di Galgenbühel/Dos de la Forca (Bolzano). In Thun Hohenstein, U., editor, *Atti del I Convegno Nazionale degli Studenti di Antropologia, Preistoria e Protostoria Ferrara, 8-10 Maggio 2004*, pages 63–66, Ferrara. Università degli Studi di Ferrara.

Wierer, U. (2008). Which blanks for which tools? Techno-typological analyses of the Sauveterrian industry at Galgenbuhel (Italy). In *Space and Time: which diachronies, which synchronies, which scales? Typology vs Technology. (XVI Congreso UISPP , Lisboa, 2006)*, BAR International Series 1831, pages 197–206. Archaeopress.

Wierer, U. and Bertola, S. (2016). The Sauveterrian Chert Assemblage of Galgenbühel Dos de la Forca (Adige Valley, South Tyrol, Italy). In *Ressources lithiques, productions et transferts entre Alpes et Méditerranée. Actes de la journée de la Société préhistorique française de Nice, 28-29 mars 2013. Séances de la Société préhistorique française, 5*, pages 229–256.

Wierer, U., Betti, L., Gala, M., Tagliacozzo, A., and Boscato, P. (2016). Seasonality and function of Mesolithic valley-bottom sites: Results from Galgenbühel/Dos de la Forca, Adige valley (South Tyrol, Italian Alps). *Quaternary International*, 423:102–122.

Wierer, U. and Boscato, P. (2006). Lo sfruttamento delle risorse animali nel sito mesolitico di Galgenbühel/Dos de la Forca, Salorno (BZ): la macrofauna. In *Archaeozoological studies in honour of Alfredo Riedel*, pages 85–98. Dipdruck.

Yaroshevich, A., Kaufman, D., Nuzhnyy, D., Bar-Yosef, O., and Weinstein-Evron, M. (2010). Design and performance of microlith implemented projectiles during the Middle and the Late Epipaleolithic of the Levant: experimental and archaeological evidence. *Journal of Archaeological Science*, 37:368–388.

Ziggiotti, S. and Peresani, M. (2001). La troncatura: uno strumento polifunzionale nei tecnocomplessi del Paleolitico superiore e del Mesolitico d'Europa. *Rivista di Scienze Preistoriche*, LI:221–234.

Zipkin, A. M., Wagner, M., McGrath, K., Brooks, A. S., and Lucas, P. W. (2014). An experimental study of hafting adhesives and the implications for compound tool technology. *PloS one*, 9(11):e112560.