



Article

First evidence of human peopling in the southern Po plain after the LGM: the early Sauveterrian site of Collecchio (Parma, Northern Italy).

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Key words

- Early Mesolithic
- Preboreal
- southern Po Plain
- organic remains
- lithic artefacts

Parole chiave

- Mesolitico antico
- Preboreale
- pianura del Po meridionale
- resti organici
- manufatti litici

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Summary

According to the current archaeological evidence human peopling in the Southern Po Plain after the LGM was delayed with respect to other areas of northern-central Italy. Although a rather rich set of sites is recorded from the plain to the main Apennines watershed, true reference points are still lacking. Within this context, Collecchio (Parma, Northern Italy) represents a key-site, attesting that stable settlement in the region began at least in the mid part of the Preboreal. This site, which is also the richest Early Mesolithic (Sauveterrian) deposit to have been extensively excavated in the southern Po Plain, has yielded a varied record of archaeological remains including organic residues and an abundant lithic assemblage that were following a multidisciplinary approach.

Riassunto

Le evidenze attualmente disponibili mostrano che il ripopolamento umano della Pianura Padana meridionale alla fine dell'UMG risulta essere piuttosto ritardato rispetto ad altre aree dell'Italia centro-settentrionale. Seppur sia attestato un cospicuo numero di siti fra la pianura e lo spartiacque appenninico, mancano effettivi punti di riferimento per quanto concerne la cronologia della prima rioccupazione dell'area. In questo contesto Collecchio (Parma, Italia settentrionale) rappresenta un sito-chiave che dimostra come, già durante la parte centrale del Preboreale sia presente un insediamento stabile della regione. Questo sito, che rappresenta il più ricco deposito del Mesolitico antico (Sauveterriano) scavato in estensione nella Pianura Padana meridionale, ha restituito una discreta varietà di reperti organici, oltre ad un abbondante insieme litico che sono stati analizzati con un approccio multidisciplinare.

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Introduction

Data on the post-glacial occupation of north-central Italy seem to reflect regional variations which derive from the mosaic of environments characterizing this area. At the same time, it should be taken into account that the reconstruction of human peopling is strongly biased by the differential preservation and visibility of the archaeological record and the intensity of research in the different territories. The best known area is the north-eastern sector of Italy, particularly the south-eastern Alps where a settlement model has been proposed starting from the rich record brought to light in the Adige basin (Broglia 1980; Cusinato *et al.* 2003; Fontana 2011; Fontana *et al.* 2011). Here human re-occupation had a considerable impulse starting from the first part of the Late Glacial and the temperate interstadial and became particularly intense in the early Holocene. The same can be affirmed for the north-western Tuscan area, where evidence brought to light in the Serchio valley attests for a Late Glacial peopling of this sector of the Apennines with a continuity of occupation throughout the first part of the Holocene (Kozłowski *et al.* 2003; Tozzi 2000).

The southern Po plain and northern Apennines area has yielded a very poor and uncertain Late Glacial record (Ghiretti 2003) while evidence on the early Holocene occupation is much richer. Nonetheless the latter still lacks reference points especially for the definition of a chronological framework in relation to environmental conditions, resource exploitation strategies and settlement dynamics (Biagi *et al.* 1980; Fontana *et al.* 2013; Fontana & Visentin 2016). Within this context Collecchio represents a key-site, having yielded the most ancient radiocarbon dates and being the richest Early Mesolithic settlement that has been extensively excavated with the recovery of a rich record of archaeological remains including organic residues (charcoal, malacofauna, macrofaunal and carpological remains) and a rich lithic assemblage. The multidisciplinary approach used for the analysis of this evidence has, therefore, allowed gaining a broader view on human occupation of this area.

The regional setting

The Po Plain has undergone a complex geomorphological evolution during the late Cenozoic. This is especially true for its southern margin, where different geomorphological features and sedimentary systems (piedmont fans vs. alluvial plain) come into contact. The fans that were mainly formed during Middle and Upper Pleistocene times were sometimes covered by loess deposits and characterized by several phases of soil formation throughout the Quaternary (see, e.g. Cremaschi 1987; Busacca & Cremaschi 1998). During the Holocene, they were partly affected by sedimentary activity and mostly interested by soil formation processes, which were more marked in the mid part of this period (Cremaschi 1990). Particularly, the sediments of the present-day alluvial plain have recorded an environmental shift at the Late Glacial to early Holocene transition with the deposition of several layers of fine-grained sediments made of sandy-clayey deposits at the base and indicating alternating phases characterized respectively by dry and wet conditions (Cremaschi 1985; Cremaschi *et al.* 1990; Cremonini 1987). In the highlands of the Apennines, researches carried out on some deposits located at altitudes between 1600 and 1800 meters in the Reggio Emilia area have shown the persistence of conditions of low vegetal cover and erosion phenomena up to the beginning of the Atlantic period (Biagi *et al.* 1980).

The most recent synthesis on the evolution of the vegetal landscape in the plain during the early Holocene indicates the presence of woodlands mostly composed of pine trees (mainly Scottish Pine), followed by silver fir and spruce during the Preboreal, while from the Boreal onwards a spread of deciduous mixed-oak forests

is documented accompanied by the presence of abundant lime trees. In the hilly areas of the Apennines mixed broadleaf forested environments were present throughout the first part of the Holocene with refuge areas for chestnut and walnut in the Preboreal and Boreal, while in the mountain sector conifers, particularly *Pinus* (accompanied by abundant *Abies*), appear as the best represented species since the Preboreal (Accorsi *et al.* 1996).

In this region early Mesolithic (Sauveterrian) human occupation is documented only by a few deposits in the plain and by a higher number of sites in the highlands. The lowland sites are geographically distributed west to east, from Piacenza to Bologna and they have been extensively investigated between 1983 and 2001 (Fig. 1). All the sites in the area of Bologna are located on alluvial fans along the banks of the streams that cross the Apennines (I.N.F.S. at the confluence of the Idice and the Quaderna fans, Casalecchio and Cava Due Portoni on the Reno fan) while the only site of the Piacenza area (Le Mose) is situated in the lowermost part of the plain near the confluence between the Nure and the river Po (Fontana and Cremona 2008; Fontana *et al.* 2009a, b). Only for the latter a radiocarbon chronology is available with the two dates of 9220 ± 50 BP, 8560-8300 cal BC (Poz-13344 for S.U. 507, Pl. 19 S, 2σ) and 8250 ± 50 BP, 7460-7130 cal BC (Poz-13343 for S.U. 507 - Locus 7,2σ) (Fontana *et al.* 2009b), even though the first and most ancient one does not appear to be directly associated to any archaeological evidence. Based on the characteristics of the lithic assemblages, the site of I.N.F.S. can be considered as more ancient than Le Mose, Cava Due Portoni and Casalecchio (Boreal?), possibly of early Preboreal age (Fontana *et al.* 2009a; Fontana & Visentin 2016). According to this evidence, plain sites were part of a wider settlement system extending at least from the river Po, to the north, to the main Apennines watershed to the south and including also the sites located on the hilly terraced surfaces that bound the main Apennines valleys (at altitudes varying between 150 and 800 m a.s.l.) and mid-highlands stations placed at altitudes between 1100 and 1800 m a.s.l. along the main inter-valleys systems and the Tusco-Emilian watershed (Biagi *et al.* 1980; Fontana *et al.* 2009c; 2013; in press; Fontana & Visentin 2016; Ghiretti & Guerreschi 1988). Almost all of these sites only comprise lithic scatters and just one has been the object of an excavation in 1970s and has yielded a radiocarbon chronology. Occupation at Monte Bagioletto Alto, located in the high Apennines of Reggio Emilia, can be placed between the Late Boreal and the first part of the Atlantic phase spanning from 7447 to 6390 cal BC (8260 ± 60 BP, B/N 2839; 7630 ± 120 BP, I-12, 520) (Cremaschi *et al.* 1984).

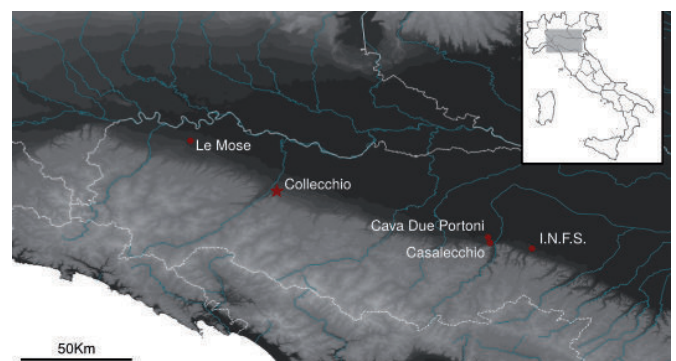


Fig. 1 - Map of the southern Po Plain showing the location of Collecchio and of the other Sauveterrian sites of the Emilian plain (elaboration by D. Visentin). / Mappa della Pianura Padana meridionale con la posizione di Collecchio e degli altri siti sauveterriani della pianura emiliana (elaborazione D. Visentin)

The site of Collecchio: geographical, environmental and chronological context

The site of Collecchio is located at the far edge of the alluvial fan of the river Taro (44.75709 °N, 10.21208 °E, WGS84), a right tributary of the river Po, approximately where the Taro fan deposits dip beneath the younger fine alluvial deposits of the Po Plain, at an altitude of 106 m a.s.l. The Taro fan is regarded as a giant alluvial fan because of its large size and its thickness. Its evolution during the Pleistocene was mostly controlled by tectonics and climate constraints (Bedulli & Valloni 2004).

The site was discovered in 1992 during development works of the town road network. The Early Mesolithic layer (S.U. 77) was identified in December 1994 under a level containing evidence of a middle Neolithic occupation (Fig. 2). All excavated sediments were water-screened and sorted in order to optimize the collection of lithic artefacts and organic remains. More than seven thousand lithic artefacts along with burnt bone fragments, seeds, charcoal, shells and burnt clay-chips were brought to light. All finds have been assigned to a spatial system based on a 33 centimetres square grid.

Site stratification was analysed in the field for an extension of several hundred meters along the trenches opened during road works. Analysis of the lateral variations of layers and stratigraphic correlation led to define a stratigraphic succession reaching a total thickness of ca. 3.5 m and observed over the whole explored area of the site (see stratigraphic column, Fig. 3), despite slight lateral variations.

The site succession can be divided into four main geoarchaeological complexes, from top to bottom:

Complex 1. The top complex (horizons Ap and C in Fig. 3) is made up of silty, massive, light yellowish brown, alluvial sediment that thickens eastwards; the topsoil which developed on this material consists of a dark, apedal, moderately organic, homogeneous Ap horizon; the base of the complex is an angular unconformity cutting the underlying complex;

Complex 2. This (2B and 2C in Fig. 3) comprises a buried soil developed from coarse alluvial sediments; the buried soil is truncated and shows a poorly developed cambic 2B horizon, brown, clayey silt, with a moderate blocky structure (locally, this horizon shows argic properties, with slight evidence of clay migration and redder colour); underneath it, polygenetic, rounded to well-rounded, alluvial gravel are found; the Neolithic evidence recorded at the site is embedded in the upper part of the B horizon;

Complex 3. Discontinuous intercalations of fine, silty, alluvial sediment, with no evidence of soil formation (3C in Fig. 3);



Fig. 2 - The site of Collecchio during excavation (photo by Archeosistemi). / Il sito di Collecchio durante lo scavo (foto Archeosistemi).

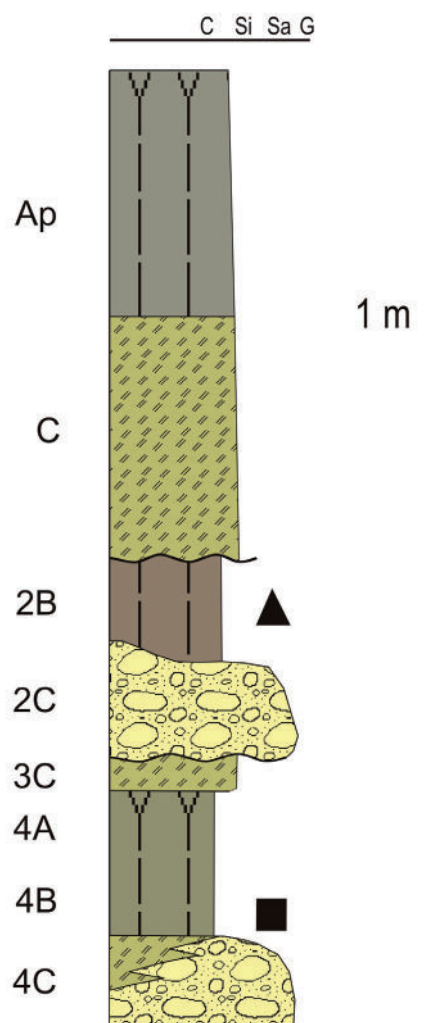


Fig. 3 - Schematic stratigraphic column of Collecchio. Key: letters and numbers to the left of the column refer to soil horizons (see text for explanation); the solid triangle and the square respectively report the positions of Neolithic and Mesolithic archaeological finds and features; C – clay; Si – silt; Sa – sand; G – gravel (Drawing by D.E. Angelucci). / Colonna stratigrafica schematica di Collecchio. Legenda: lettere e numeri sulla sinistra si riferiscono agli orizzonti del suolo (si veda il testo per spiegazioni); il triangolo e il quadrato indicano rispettivamente la posizione dei reperti e delle strutture neolitiche e mesolitiche; C – argilla; Si – limo; Sa – sabbia; G – ghiaia (disegno D.E. Angelucci).

Complex 4. A thick buried soil is preserved in the lowermost complex of the stratigraphic succession (4A, 4B and 4C in Fig. 3); this soil is articulated as follows: 4A horizon, organic, dark brown clay with prismatic structure and clear vertic fissures; 4B horizon, dark brown clay, with blocky structure and common slicken sides; 4BC horizon, transitional to the underlying 4C horizon, which is laterally variable and is silty, massive light yellowish brown alluvial sediment featuring lenticular bodies of rounded to well-rounded polygenetic gravel; the Mesolithic record is stratigraphically located at the base of the buried soil.

The complexes 2, 3 and 4 dip westwards with a low angle, while complex 1 is sub-horizontal.

Archaeological record at the site is embedded in buried soil profiles found inside the alluvial sediment of the Taro fan and sealed by the younger fine deposit of the Po alluvial plain. The complexes 2, 3

and 4 are related to the alluvial fan of the river Taro; distinct phases of alluvial activity are documented alternating with stable phases. Complex 4 represents a first cycle of alluvial sedimentary action, with coarse deposit attesting to medium-high energy and a subsequent soil formation phase leading to the development of the buried vertisol (horizons 4A, 4B and 4BC). The Sauveterrian assemblages and the dating obtained from the early Mesolithic layers, which falls within the Preboreal zone-belong to the alluvial sediment of horizon 4C and are older than the development of the buried vertisol. This indicates that soil formation may date to the Boreal, while alluvial aggradation can be attributed to the early Preboreal or to the late upper Pleistocene. Early Mesolithic hunter-gatherers probably settled the site at the beginning of the stable phase during which the vertic soil would later develop. Two other phases of alluvial activity are documented, respectively, by complexes 3 and 2. The latter is sealed by a buried soil featuring Neolithic archaeological evidence, which can be approximately dated to the Atlantic period. The Atlantic soil formation phase is well documented in the Po plain and Neolithic evidence is often related to mid-Holocene soil profiles (Cremaschi 1987; Cremaschi 1990). The subsequent erosion of the buried soil and the ingression of fine alluvial deposit belonging to the Po sedimentary system (complex 1) are post-Atlantic in age.

Radiometric dates

Two radiocarbon accelerator mass spectrometry (AMS) dates are available for the Mesolithic deposits: 9251 – 8814 cal BC (9643 ± 70 BP, LTL6147A, burnt hazelnut, 2σ, -17.0 ± 0.4 δ¹³C) and 9119 – 8564 cal BC (9442 ± 60 BP, LTL12390A, wood charcoal, 2σ, -31.9 ± 0.5 δ¹³C). Samples calibration has been carried out with OxCal Ver. 4.2.4 software based on atmospheric data (Reimer *et al.* 2013). Both dates refer to the middle part of the Preboreal zone. In this context the site of Collecchio represents the first undeniable evidence of re-occupation of the southern Po Plain after the Last Glacial Maximum.

Malacofaunal remains

Several snail shells were retrieved from archaeological excavation and were determined. They can be referred to three species of terrestrial pulmonate gastropods: *Chondrula tridens* (O.F. Müller, 1774), *Cernuella* cf. *cisalpina* (Rossmassler, 1837) and *Cepaea* cf. *nemoralis* (Linnaeus, 1758).

Chondrula tridens (O.F. Müller, 1774)

Dimensions: height = 9–12 mm; diameter = 4–4.5 mm (Kerney & Cameron 2006).

Snail with dextral shell, cylindrical-conical shape, with 7–8 weakly convex laps; strongly thickened and reflected peristome; aperture with three major teeth, one columellar, one parietal and one palatal. It prefers calcareous and dry environments but can also be easily found in meadows and rocky areas. It is rare at altitudes over 700 m above sea level (Kerney and Cameron 2006).

The shells analysed and identified as belonging to this species are extremely damaged. The identification was possible thanks to the presence of numerous fragments of the peristome of the shell, which is fundamental for its identification.

Cernuella cf. *cisalpina* (Rossmassler, 1837)

Dimensions: height = 5–9 mm; diameter = 7–12 mm (Giusti & Castagnolo 1982).

Snail with dextral shell, subglobose shape, with 5–6 convex whorls separated by deep sutures, yellowish-white colour, with continuous brown bands or divided by irregular spots; external surface with thick and rough growth lines; sub-circular aperture; lightly reflected peristome (Giusti & Castagnolo 1982). It can be easily found along the borders of herbaceous spontaneous vegetation of cropland (Ferreri 1994) and in meadows (Cossignani & Cossignani 1995).

The shells analysed and identified as belonging to this species are extremely damaged; therefore species determination is not certain because of the polymorphism within the genus *Cernuella* (Manganeli *et al.* 1995).

Cepaea cf. *nemoralis* (Linnaeus, 1758)

Snail with dextral shell, medium to large size, globose shape, more or less depressed, with 5 convex whorls; reflected, thickened and brown-blackish peristome (Lazzari 2007); external surface with more or less marked and irregular growth lines (Kerney & Cameron 2006). This species is characterized by a large polychromy of the shell (Lazzari 2007). This snail is widespread in the forests, particularly those of deciduous trees and evergreen sclerophyllous where it lives in the meadows and dunes.

The shells analysed and identified as belonging to this species are extremely damaged. The determination was based on the size and ornamentation of the shell and on the peristome. The peristome is either missing or appears discolored in the samples; therefore it is not possible to provide a determination to species level because of the presence of a species with white peristome (*Cepaea hortensis*) within this kind. Since *C. hortensis* is a species not reported in the Italian territory as opposed to *C. nemoralis* (Manganeli *et al.* 1995), it can be affirmed with reasonable certainty that the shells belong to the latter species. Both *Cepaea* cf. *nemoralis* and *Cernuella* cf. *cisalpina* are still living edible gastropods.

Charcoal and carpological analysis

Anthracological and carpological findings have been studied with a stereomicroscope and a reflected light microscope. In total 583 charcoals and 33 remains of seeds were examined (Table 1). Charcoal fragments are generally well preserved, although their dimensions are reduced, usually being smaller than a few millimetres. Edges are quite irregular, thus attesting an *in loco* deposition, without further displacement due to water and weathering.

498 charcoal fragments have been determined and 19 taxa have been identified. The dominant species are *Castanea sativa* (n. 103 + 118 probable remains) and *Populus* (n. 31) or *Populus-Salix* (n. 139). *Quercus* deciduous is also well represented with 65 charcoal fragments, 41 of which can be attributed to *Quercus* sect. *robur* and 27 to *Quercus* cf. *robur*. The other species are not so well represented: *Fraxinus oxycarpa* (n. 10), *Fraxinus* cf. (n. 1), *Ostrya carpinifolia* (n. 7), *Ostrya* cf. (n. 8), *Frangula alnus* (n. 6), *Crataegus* cf. (n. 4), *Viburnum* cf. (n. 2), *Acer* cf. *campestre* (n. 1), *Juglans* cf. (n. 1), *Abies* cf. (n. 1) and *Pinus* cf. (n. 1).

The carpological analysis has allowed identifying 33 fragments of *Corylus avellana* that can be referred to a total of 9–10 hazelnuts.

According to the analysis of charcoal remains, the arboreal component is 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 oak-wood (*Quercetum*), such as oak, hornbeam, ash, maple and thorn tree (Accorsi *et al.* 1996). Chestnut is a species that has survived the Last Glacial Maximum in the Po Plain on hilly refuge areas together with walnut, mainly as a spontaneous component of mixed deciduous broadleaves wood (Accorsi *et al.* 2000a). Different studies have highlighted that this species was widespread in the hilly lands since the Preboreal (Bandini Mazzanti *et al.* 2000). The presence of the poplar-willow can be attributed to the location of the site on the Taro river alluvial fan. Actually, this hygrophilous species lives along the rivers shores, particularly on their middle-hilly and final sectors, where floods are more frequent.

The use of chestnut, poplar-willow and oak wood as combustible is probably due to their presence in the proximity of the site. This is particularly clear for chestnut—a species typical of wooded hilly and low mountain environments—that has always been used for various purposes. Its origin remains uncertain but some studies confirm that

Tab. 1 - Collecchio, taxa identified by charcoal analysis; nomenclature according to Pignatti 1982. / Collecchio, taxa identificati tramite l'analisi antracologica; nomenclatura in accordo a Pignatti 1982.

| Family | Taxa | Tot. | % |
|---------------------|-----------------------------------|------------|-------------|
| Aceraceae | <i>Acer</i> cf. <i>campestre</i> | 1 | 0.2% |
| Caprifoliaceae | <i>Viburnum</i> | 2 | 0.3% |
| Corylaceae | <i>Ostrya carpinifolia</i> Scop. | 7 | 1.2% |
| | <i>Ostrya</i> cf. | 8 | 1.4% |
| | <i>Castanea sativa</i> Miller | 191 | 32.7% |
| Fagaceae | <i>Castanea</i> cf. | 30 | 5.2% |
| | <i>Quercus</i> cf. <i>robur</i> | 27 | 4.6% |
| | <i>Quercus</i> sect. <i>robur</i> | 14 | 2.4% |
| | <i>Quercus</i> <i>deciduous</i> | 24 | 4.1% |
| Juglandaceae | <i>Juglans</i> cf. | 1 | 0.2% |
| Oleaceae | <i>Fraxinus oxycarpa</i> Bieb. | 10 | 1.7% |
| | <i>Fraxinus</i> | 1 | 0.2% |
| | <i>Abies</i> cf. | 1 | 0.2% |
| Pinaceae | <i>Pinus</i> cf. | 1 | 0.2% |
| Rhamnaceae | <i>Frangula alnus</i> Miller | 6 | 1.0% |
| Rosaceae | <i>Crataegus</i> cf. | 4 | 0.7% |
| Salicaceae | <i>Populus</i> | 31 | 5.3% |
| | <i>Populus/Salix</i> | 139 | 23.9% |
| Undetermined | | 85 | 14.5% |
| Total | | 583 | 100% |
| Trees | | 473 | 81.1% |
| Shrubs | | 25 | 4.3% |
| Deciduous broadleaf | | 496 | 85.1% |
| Quercetum | | 100 | 17.1% |
| Edible fruits | | 287 | 49.2% |
| Conifer | | 2 | 0.4% |
| Hygrophilous plants | | 170 | 29.2% |

Castanea sativa was an indigenous north Italian species (Paganelli & Miola 1991; Krebs *et al.* 2004).

Concerning the characteristics of the selected woods, chestnut is compact, elastic and not very heavy, indicated as fuel only if appositely dried; the wood of poplar-willow is useful only during the first phases of fire-lightening because of its rapid combustion. The only species represented at Collecchio which is ideal for combustion and heat preservation is oak wood. We can thus hypothesize that different species were adopted for lightening-up the fire, such as poplar, together with small branches of other species, while during its maintenance chestnut and oak wood were preferred.

Faunal remains

The faunal remains coming from the site of Collecchio (totally 2295 elements or fragments) are mainly composed of small bone fragments (below 1 cm length) strongly modified by burning (black colored and calcinated fragments). The identified specimens are therefore very scarce (25) and belong to wild boar (17), hare (4),

fox (1) and wild cat (3). It is not possible to estimate the Minimum Number of Individuals because of the high degree of fragmentation, but the remains of wild boar can be attributed to a young individual on the basis of the presence of unfused bones and one unerupted first molar. The majority of the 27 elements identified on anatomical basis refers 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 europeus*.

The lithic assemblage

Raw material provisioning

A large spectrum of lithologies has been flaked at Collecchio. The first group includes silicified cherts and radiolarites from different sedimentary formations (Triassic to Miocene) and the second one fine crystalline Cretaceous limestones and Miocene marls and sandstones/siltstones. They all belong to the stratigraphic sequences of the Northern Apennines. This region is characterized by a very complex geological stratigraphy including a large variety of rocks. The raw materials exploited at Collecchio refer to deep marine and fore-land basins (flysch) formations. They have been grouped on the basis of their lithology, age and texture. For each group both the geological formation (Fm) and the geographic provenance have been investigated. Identification has been carried out by comparing archaeological to geological samples collected through extensive surveys on the territory. An attribution to different paleogeographic domains has thus been possible:

Umbro-Tuscan units (Calcarei Selciferi, Scisti Diasprigni and Maiolica); Triassic-Cretaceous age.

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 (silified marls and siltstones from the Antognola and Contignaco formations); Oligocene-Miocene age.

As attested by external surfaces, raw material provisioning at Collecchio mostly took place within the alluvial and slope deposits of the main northern Apennine valleys (Taro, Baganza and Enza). A few artefacts are characterized by well rounded edges attesting a strong river transportation but more frequently edges are sub-angular which is a morphology associated with either gravitational or hill slope sediment transportation. Particularly, cherts were mostly extracted from the residual soils situated at the base of the outcrops as it is suggested by the presence of deep patinas with iron and manganese oxides.

The lithologies described are present in the site with different proportions and seem to have been sorted according to their textural properties and knapping suitability. The group of cherts (particularly the Cretaceous ones) is the best represented (58.4%) but red radiolarites are also abundant (20.8%). A peculiar aspect is the exploitation of partially silified lithologies such as the limestones of the Palombini Shales (5.0%) and Cherty Limestones Formations (1.3%) and spiculitic limestones (5.2%) together with a coarser siltstone (9.3%) from the Antognola Formation.

It is interesting to note that the Plio-Pleistocene silicified marine pebbles included in the Sabbie Gialle Formation have not been used at Collecchio although they crop out all along the lower Apennines and were abundantly exploited by the Mesolithic groups attested further east in the Bologna area. Allochthonous raw materials such as the Alpine or pre-Alpine cherts are also not attested.

The reconstruction of the provisioning territory suggests 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 (Fig. 4).

Technological analysis

The lithic assemblage consists of 7697 artefacts, 2785 of which have been considered as diagnostic for technological analysis. Blanks less than 1 cm in length have been counted (825) and sorted by lithology; *debris* and undetermined fragments smaller than 2 cm have been divided on the basis of presence (1500) or absence (2587) of heat alteration.

Overall the lithic assemblage shows a good preservation state: more than 50% of the artefacts entered in the database are entire and the percentage of items attesting edge damage, presence of patina and/or other mechanical/chemical post-depositional alterations is rather low (15%). These data confirm the rapid burial of the archaeological deposit after abandonment of the site by the Mesolithic groups as also suggested by the characteristics of the sedimentological context and the results of spatial analysis (Visentin & Fontana 2016).

For technological analysis the different lithologies identified have been grouped into three main classes according to their technical properties and knapping suitability. The best quality one (A) is represented by the finest cherts and radiolarites, the second one (B) by more or less silicified limestones, spiculitic cherts and radiolarites and the third one (C) by low silicified coarse marly siltstones.

A refitting program has also been carried out which has resulted in the highest rate of refittings for a Mesolithic site in the Italian peninsula. It amounts to 13% of the analysed pieces, with a total number of 329 items, divided into 122 complexes composed of two or more elements. The highest number of artefacts involved in a single refitting complex is 12. Three types of refitting have been identified: reduction sequences, breaks and modifications (Cziesla 1990). Those related to reduction are representative of all the stages: from the initializing phase to the abandonment of cores (Figs. 5, 6). Many complexes are formed by a series of partially cortical flakes, while others-missing just the first cortical flakes-include almost all the products up to the abandonment of cores, thus confirming that all these operations took place on site. Also a few retouched pieces have been refitted and positioned into the refitted complexes.

Two main reduction sequences have been identified by the technological analysis of diagnostic lithic artefacts and refitting complexes. The first one is adapted to the finest cherts while mid-quality radiolarites and limestones and the other one to siltstone.

The first reduction sequence is aimed at the production of bladelets, small lamellar flakes and flakes. The dimensional values of bladelets and lamellar flakes range from 10 to 40 mm in length and from 5 to 15 mm in width. Raw blocks are represented by nodules and nodule fragments, mostly showing a naturally suitable shape and in particular natural fractures characterized by thick patinas which appear good to be used directly as striking platforms. The use of thick cortical flakes as supports for knapping is also quite common.

The most frequent types of cores are burin-like (Visentin et al. 2014) and prismatic ones. The two of them account for almost 60% of the first class of raw materials (finest cherts) and almost 80% of the second one (mid-quality radiolarites and limestones). Other types are represented by polyhedral and pyramidal cores which are mostly found in the class of finest chert that also includes a couple of peripheric cores. Within this reduction sequence blanks selection for transformation by retouch is not very marked although some general trends can be identified. For the production of microliths, (micro) bladelets and small flakes belonging to the finest quality group (A) were preferably chosen while blanks used for tools belong to the two groups (A and B) with a same percentage.

The second reduction sequence aims at the production of large partially cortical and natural backed flakes through the exploitation of siltstone blocks. The dimensional range of the products is quite wide

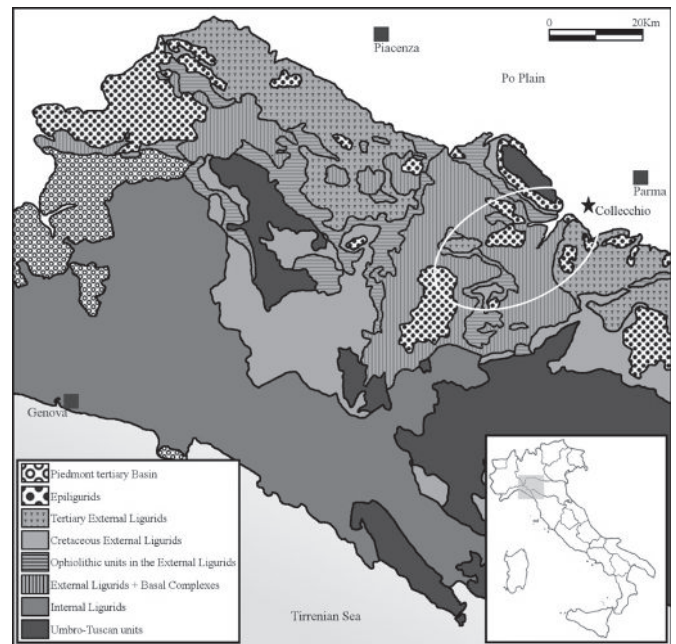


Fig. 4 - Provisioning territory proposed for the site of Collecchio (modified from Elter & Marroni 1991). / Territorio di approvvigionamento proposto per il sito di Collecchio (modificato da Elter & Marroni 1991).

ranging between 20 and 70 mm in both length and width. There are no cores in the archaeological assemblage which can be referred to this reduction sequence. No shaping out of the blocks is attested but cortical flakes are pragmatically struck off the core followed by the removal of some series of partially cortical flakes which are the main product of this reduction sequence. Flakes are usually plunged and characterized by cortex both on the butt, on one of the two edges and on the distal end.

The excavation has also yielded a flat cobble used as a stone-hammer and a few fragments and flakes belonging to the same raw material (coarse sandstone) that have been interpreted as fragments of hammers.

Typological analysis

The lithic assemblage includes 224 retouched blanks and 11 wastes of backed tool manufacturing among which 3 microburins, 4 fractured notches and 4 Krukowski microburins (Table 2, Figs. 7, 8). Tools dominate over microliths (143 vs. 81) and burins constitute the best represented type.

Among burins (50) "simple" types are the best represented-with removals starting from a flat natural surface-followed by those characterized by a transversal truncation and a lateral removal. On the other hand, end-scrapers are poorly represented. Among the remaining tools the best represented ones are truncated bladelets (19), denticulates (19) and backed flakes (16), followed by scrapers (13), blade scrapers (3) and splintered pieces (2). The 4 multiple tools include, two burins opposed to denticulate tools, a burin opposed to an end-scraper and a fragmented backed element opposed to a denticulate.

As far as armatures are concerned, the assemblage has yielded 13 backed points, 12 geometric microliths, 8 backed and truncated bladelets and 3 backed bladelets. Three backed points belong to *Sauveterre* types, characterized by double backed sides and points. The geometric types are represented almost entirely by crescents, while just one scalene triangle is attested. The use of the microburin technique is documented by the presence of 3 microburins and by 4 microliths bearing a *piquant trièdre* at one of the extremities.

1. partially cortical flake;
2. partially cortical flake;
3. partially cortical flake;
4. partially cortical flake;
5. hinged flake;
6. hinged flake;
7. hinged flake.

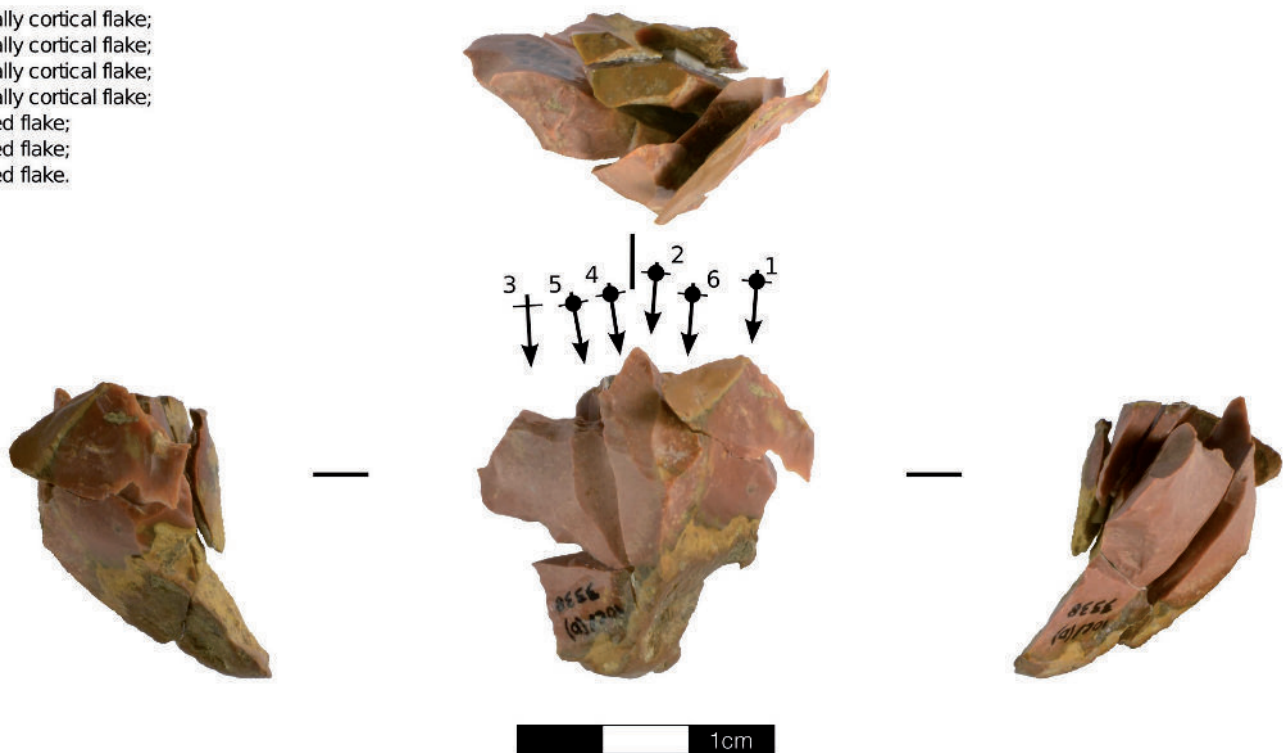


Fig. 5 - Refitting assemblage attesting unidirectional exploitation of a core. Debitage products are symbolized by a crossed arrow; a solid circle indicates the presence of the butt (photo by D. Visentin). / Rimontaggio attestante uno sfruttamento unidirezionale del nucleo. I prodotti di débitage sono indicati da una freccia incrociata; un cerchio pieno indica la presenza del tallone (foto D. Visentin).

1. cortical backed flake;
2. cortical backed flake;
3. flake;
4. opening flake of a second debitage surface;
- 5-6. cortical backed flake (conjoining of the two lateral halves);
- 7-8. cortical backed flake (conjoining of the two lateral halves), both trasformed into backed flakes;
9. retouch flake trasformed into a backed element;
10. cortical backed bladelet;
11. small flake;
12. missing flake of good quality chert.

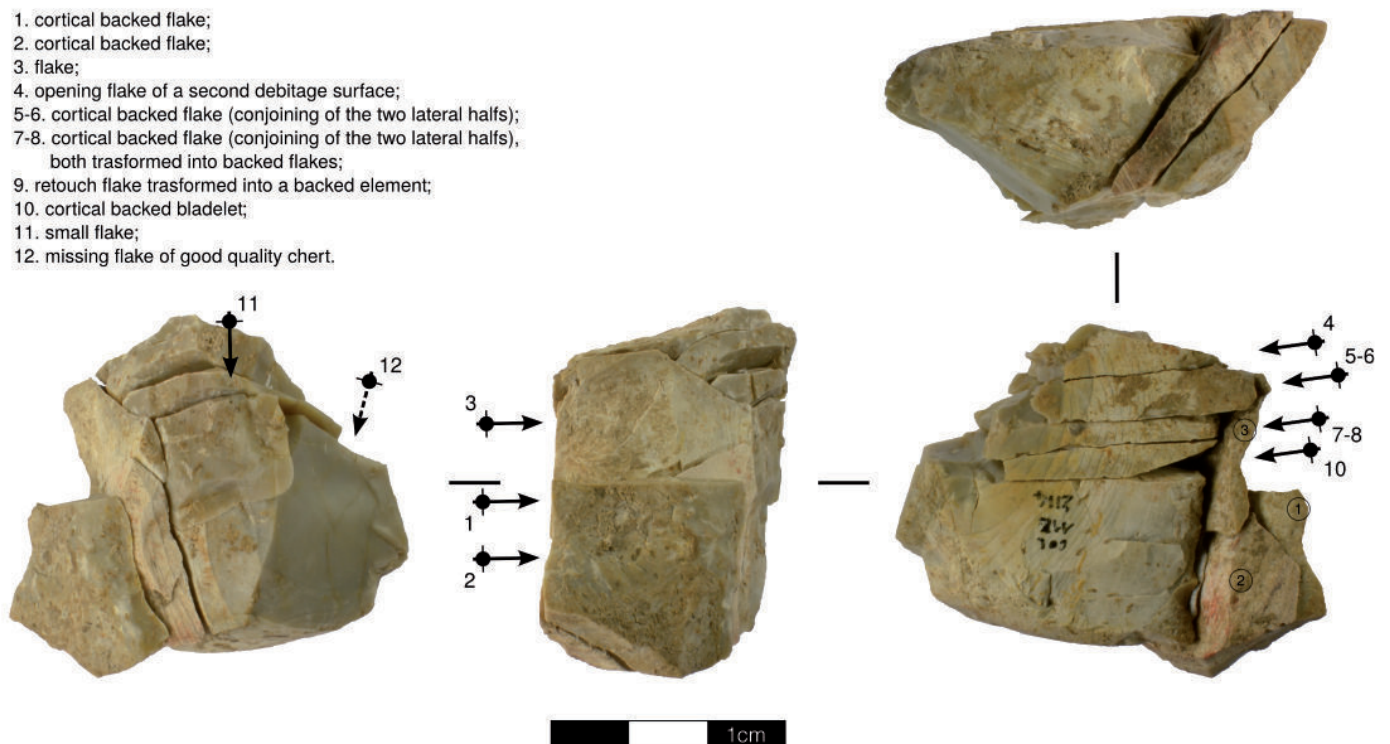


Fig. 6 - Refitting assemblage attesting orthogonal reorientation. Debitage products are symbolized by a crossed arrow; a solid circle indicates the presence of the butt (photo by D. Visentin). / Rimontaggio attestante riorientamenti ortogonali. I prodotti di débitage sono indicati da una freccia incrociata; un cerchio pieno indica la presenza del tallone (foto D. Visentin).

Use-wear analysis

Use-wear analysis has been carried out through an integrated approach (Moss 1983; Vaughan 1985; Plisson 1985; Beyries 1987; Christensen 1996; Lemorini 2000; Pawlik 2011). This methodology is based on both low (Odell 1981; Tringham et al. 1974) and high power approaches (Keeley 1980). A stereomicroscope Seben Inco-gnita III (20x-80x) has been used for the low magnification analysis and a metallographic microscope Leica DMLM (100x, 200x) for the high magnification one.

An experimental collection composed of about 300 artefacts obtained from the most represented raw materials and particularly from radiolarite and siltstone has been created. The analysis of this experimental series has shown that the formation of use-wear traces on radiolarite blanks is comparable to the one obtained on the chert artefacts. Contrarily, siltstone artefacts show a different pattern. At a low magnification the analysis of edges shows marked and widespread use-wear traces that lead to a rapid dulling of the blanks, thus attesting their lower efficiency compared to the chert and radiolarite ones. The irregular surfaces that characterize these blanks have not allowed any profitable analysis with a metallographic microscope. In particular no diagnostic features for identification and description of micro-polishes could be detected.

The recognition of the hardness of the worked materials has been carried out according to Odell's classification (1981) integrated by the experimental collection, while both experimental results and bibliographic references have been used to identify micro-polishes (Beyries 1987; Fischer et al. 1984; Gassin 1996; Moss 1983; Plisson 1985; Rots 2002).

235 retouched artefacts have been selected for analysis along with 236 unretouched blanks featuring the following characteristics: presence of functional edges, absence of fractures and post-depositional alteration, absence of traces due to field and laboratory damage, absence of thermal alteration. After analysis 51 retouched and 54 unretouched blanks have revealed the presence of use-wear traces (Table 3).

Among retouched artefacts the best represented group is that of burins. 9 out of 55 have allowed identifying the presence of use-wear traces; transversal actions on a hard material dominate. In two cases these could be identified as due to wood processing (Fig. 9).

The position of traces suggests that the main functional edges were either the lateral dihedral formed by the burin facet or the truncation while no evidence was identified on the tips (trihedral). Sometimes use-wear traces were recognized on the natural edges of the blanks recording the same use as that shown by the burin dihedral. Use-wear traces on some burin spalls were also recorded and testify the rejuvenation of the functional edge after the first utilization (n. 12). Microscopic analysis attests that burins have been used with a unidirectional transversal action. Only in a few cases (n. 3) unmodified edges have been used on soft/mid-soft materials; in one of these, worked material has been identified as animal tissue, with a bidirectional longitudinal movement. In one case, functional continuity before and after the removal of a burin spall was documented thanks to refitting. Similar use-wear traces were in fact identified both on the truncation removed with the burin spall and on the dihedral obtained by its removal (Fig. 10). A hypothesis can be advanced on the dynamics of use of these tools which involves two stages: at first the natural edges of the blanks or the truncations were used on different materials; then by removing one or more burin spalls, dihedrals were obtained and used for working hard materials.

As far as the other tool types are concerned, 2 among 7 end-scrapers have yielded traces interpreted as due to hide-working. The same traces were identified on a backed retouched flake which also showed use-wear connected to hafting, i.e. some bright spots located at the centre of the tool (cf. Rots 2002).

Three other backed retouched flakes have traces which in two cases are due to working on hard materials with a transversal action and in the other on animal soft tissues-using an unmodified edge.

Tab. 2 - Collecchio, typological structure of the lithic assemblage. / Collecchio, struttura tipologica dell'insieme litico.

| RETOUCHED BLANKS | TOT. | % |
|--------------------------------|------------|--------------|
| Tools | 143 | 63.8% |
| Burins | 50 | 22.3% |
| End-scrapers | 6 | 2.7% |
| Truncated bladelets | 19 | 8.5% |
| Backed flakes | 16 | 7.1% |
| Scrapers | 13 | 5.8% |
| Blade scrapers | 3 | 1.3% |
| Denticulates | 19 | 8.5% |
| Splintered pieces | 2 | 0.9% |
| Composite tools | 4 | 1.8% |
| Retouched fragments | 11 | 4.9% |
| Microliths | 81 | 36.2% |
| Backed points | 14 | 6.3% |
| Backed bladelets | 3 | 1.3% |
| Backed and truncated bladelets | 4 | 1.8% |
| Crescents | 11 | 4.9% |
| Scalene triangles | 1 | 0.4% |
| Backed fragments | 48 | 21.4% |
| Total | 224 | 100% |

The same activity-working of mid-hard materials with unidirectional transversal movements-is attested also by three truncated bladelets. The location of traces on the latter suggests that this activity was carried out by using the lateral natural edge as already proposed for other European Mesolithic sites (Philibert 2002). Scrapers and denticulates also reflect transversal actions mainly on hard materials, more rarely on mid-soft ones. Only one blade-scraper has yielded use-wear traces which are connected to the cutting of 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*).

The presence of use-wear traces on a splintered piece has shown its use on a soft material with a rotary action.

About 20% of the microliths (16 elements among 81) are characterized by impact fractures which confirm their role as projectile implements (points or barbs). Fractures are present on some undetermined/fragmented backed artefacts (n. 10), 4 crescents, 1 backed and truncated bladelet and 1 triangle. On 3 of them some traces of a longitudinal action on soft animal tissues have also been identified enabling us to assume that they were recycled as implements on composite cutting tools. The same traces are present on 2 backed points and 1 backed and truncated bladelet not affected by impact fractures. Finally 2 of the 3 backed bladelets show use-wear traces on their unmodified edges which indicate a transversal unidirectional action on hard/mid-hard materials while one backed fragment attests working of the same material with longitudinal movements.

Unretouched blanks show a high variability of actions-longitudinal and transversal movements-and worked materials-hard/mid-hard and soft. The analysis of blanks with use-wear traces in relation to the phase of the reduction sequence has shown that production and production/maintenance blanks have been used for working soft and mid-soft materials with longitudinal movements while a greater variety of blanks, including partially cortical flakes and maintenance flakes, have been used for working mid-hard and hard materials with transversal movements.

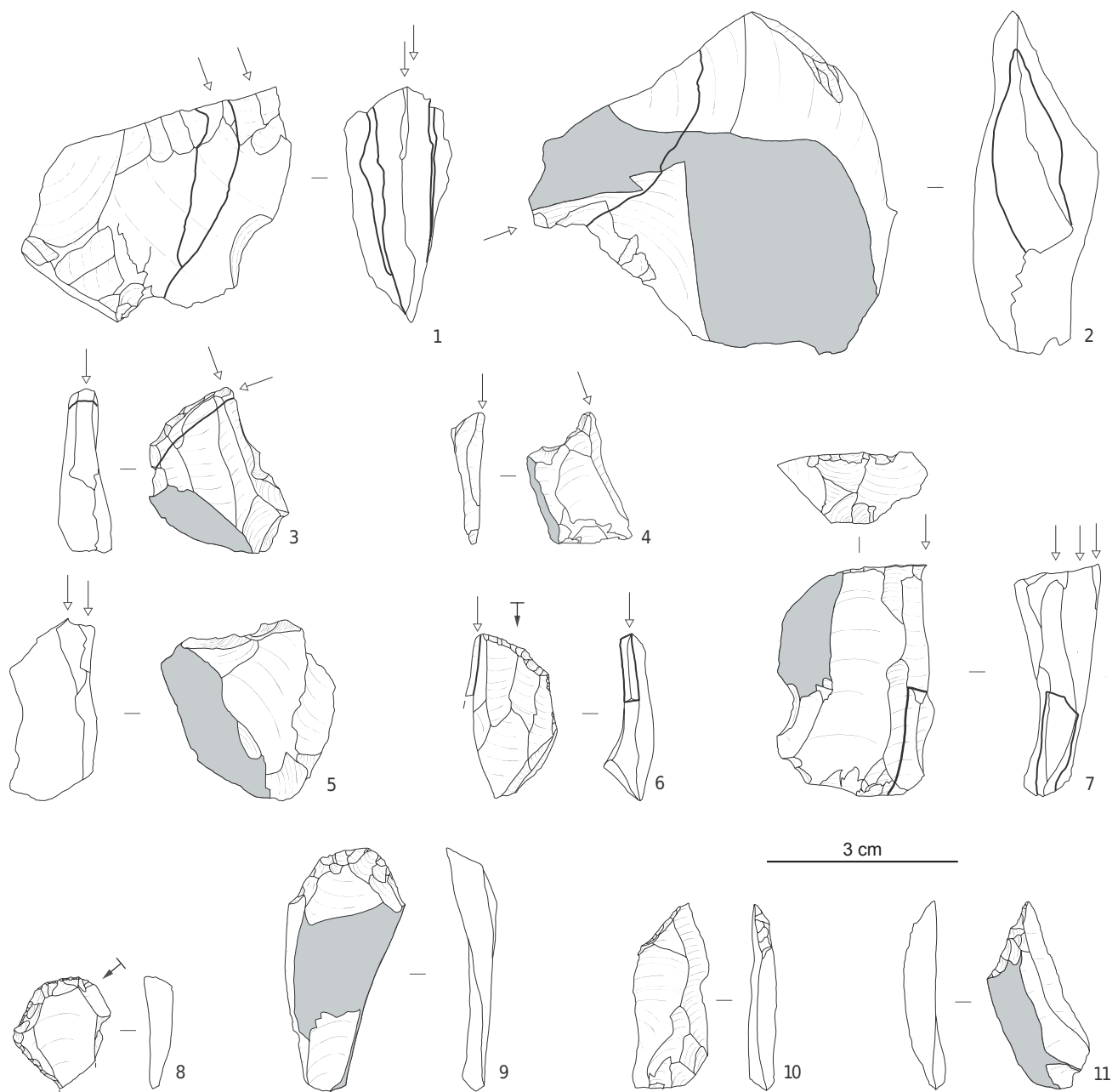


Fig. 7 - Collecchio, lithic industry: 1-2, 6-7. burins and corresponding burin spalls; 3. burin with rejuvenation; 4-5. burins; 8-9. endscrapers; 10-11. oblique truncated bladelets (drawings by S. Ferrari). / Collecchio, industria litica: 1-2, 6-7. bulini e rispettivi ritagli di bulino; 3. bulino con ravnivamenti; 4-5. bulini; 8-9. grattatoi; 10-11. troncature oblique (disegni S. Ferrari).

Discussion

Due to preservation condition of the archaeological record, the reconstruction of the Early Holocene palaeoenvironmental background in the southern Po plain has mostly been based on sedimentary and palynological data (cfr. *supra*). Within this context Collecchio is the only lowland site having yielded a variety of remains which, although not abundant, allow integrating with new data the poor evidence available for this area. Particularly, charcoal remains indicate that the area surrounding the site was characterized by an arboreal vegetal cover of deciduous broadleaves dominated by chestnut, *Populus-Salix*, oak and other species of the mixed *quercetum* wood while the three land shell species attested highlight the presence of both dry and sunny places without arboreal vegetation (*Chondrula*

tridens and *Cernuella* cf. *Cisalpine*) and of woods formed by deciduous trees and/or evergreen sclerophyll ones (*Cepaea* cf. *nemoralis*). Also the composition of the faunal assemblage which includes wild boar, hare, fox and wild cat, points to the presence of both open environments and forests near humid areas. Faunal remains are attested also at the other plain sites but determination is available so far only I.N.F.S. where some teeth of *Sus scrofa* and some antler fragments of an unidentified *Cervidae* are reported (Farabegoli *et al.* 1994). By contrast in the Apennines highland sector where the only available evidence comes from the site of Monte Baggioletto in the Reggio Emilia area (1750 m a.s.l.), charcoal remains indicate a forest dominated by *Abies* associated to *Fraxinus* sp. and *Ulmus/Laburnum* (Cremaschi *et al.* 1984).

A richer record is available for the technical systems adopted

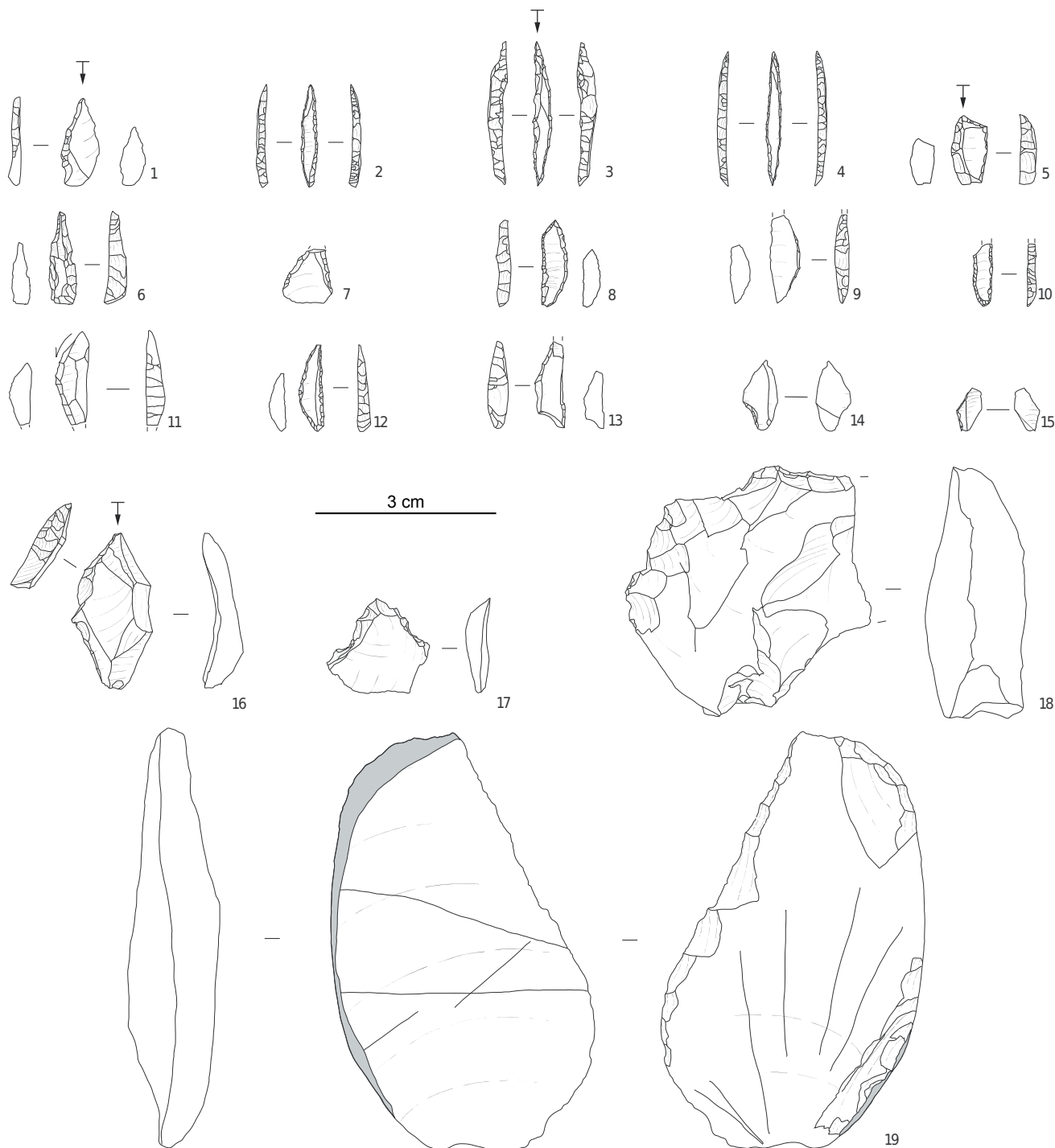


Fig. 8 - Collecchio, lithic industry: 1. backed point; 2-4. double backed points; 5. backed and truncated bladelet; 6. backed and truncated point; 7. backed fragment; 8-12. crescents; 13. scalene triangle with impact fracture; 14. microburin; 15. Krukowski microburin; 16. partially backed point; 17-18. denticulated endscrapers; 19. backed flake (Drawings by S. Ferrari). / Collecchio, industria litica: 1. punta a dorso; 2-4. punte a doppio dorso; 5. lamella a dorso e troncatura; 6. punta a dorso e troncatura; 7. frammenti a dorso; 8-12. segmenti; 13. triangolo scaleno con frattura da impatto; 14. microbulino; 15. microbulino Krukowski; 16. punta a dorso parziale; 17-18. grattatoi denticolati; 19. scheggia a ritocco erto (disegni S. Ferrari).

by the early Mesolithic groups settled in the area (Fontana & Visentin 2016). Some common features in lithic raw materials exploitation are observable between the different sites of this lowland territory, namely INFS, Casalecchio and Cava Due Portoni in the Bologna area and Le Mose, near Piacenza (Fontana *et al.* 2009a; Fontana and Cremona 2008). For all of them the documented range of lithologies reflects provisioning systems established along the main drain-

nage systems, with north-east to south-west displacements. This aspect is confirmed by the composition of the lithic assemblages of the mountain deposits scattered along the northern side of the Tusco-Emilian Apennines (Biagi *et al.* 1980) while only at one of the plain sites (Cava Due Portoni) the presence of a few implements made on extra-regional raw materials (possibly a radiolarite from the Parma/Piacenza area and cherts from the Southern Alps) has been

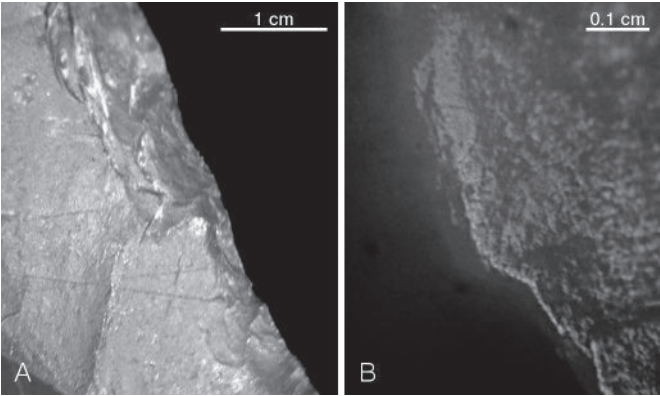


Fig. 9 - Micro-traces interpretable as working of wood with a transversal action identified on the truncation of a burin (Photo by G.L.F. Berruti, A. magnification 65x, B. magnification 100x). / Micro-tracce sulla troncatura di un bulino riferibili alla lavorazione del legno con un'azione trasversale (Foto G.L.F. Berruti, A. ingrandimento 65x, B. ingrandimento 100x)

identified, attesting mobility and/or contacts over longer distances (Cremaschi *et al.* 1990; Fontana *et al.* 2009a; 2009b; Fontana & Cremona 2008; Fontana & Visentin 2016).

The types and quality of exploited raw materials attest to the coexistence of higher and lower quality lithologies at Collecchio as well as at the sites of the Bologna area (Fontana *et al.* 2009a; Fontana and Cremona 2008). Nonetheless, separated reduction sequences specifically adapted to the different lithologies are only present at Collecchio and INFS. At the latter fine flints from small marine pebbles of the “Sabbie Gialle” formation are aimed at a lamellar production for the preparation of microliths whereas the coarser siltstone (locally named “ftanite”), available as large size river blocks, is mostly knapped in order to obtain large laminar flakes which were transformed into a variety of tools (Farabegoli *et al.* 1994; Fontana & Guerreschi 2009).

At all plain sites tool kits are dominated by microliths with the exception of Collecchio where tools, namely burins, are the most represented. It is also interesting to point out that at INFS and Collecchio triangles are absent and microliths mainly represented by crescents and Sauveterre points, an aspect which could reflect the close chronology of the two sites, possibly older than the others where triangles especially of the scalene type are well documented. This hypothesis is reinforced by the discrete presence of backed and truncated bladelets at the two sites but needs to be confirmed by radiometric dating that are still missing for I.N.F.S.

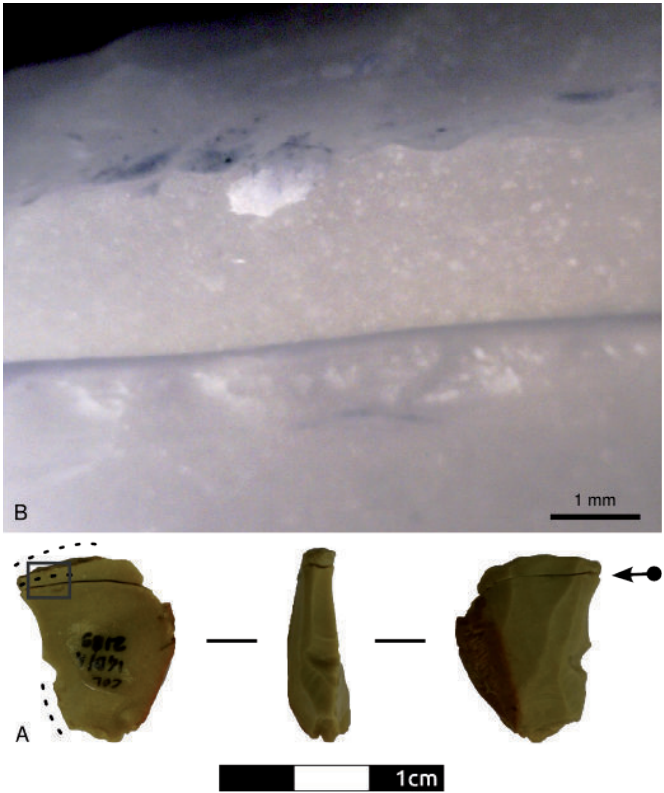


Fig. 10 - Refitting of a burin with its transversal burin spall (A) and detail showing use-wear traces on both of them (Photo A by D. Visentin and B by G.L.F. Berruti). / Rimontaggio di un bulino con il suo ritaglio trasversale (A) e dettaglio sulle tracce d'uso presenti su entrambi (foto A D. Visentin e B G.L.F. Berruti)

As far as functional analysis is concerned there are no sites for comparison in the region and only two in Northern Italy (Mondeval de Sora, 2150 m a.s.l., in the Belluno Dolomites, and Casera Lissandri 17, 1070 m a.s.l., on the Cansiglio Plateau) both dominated by hunting activities and practices connected to the exploitation of animal carcasses (Fontana *et al.* 2009c; Peresani *et al.* 2009; Visentin *et al.* 2016).

Conclusions

According to two available radiometric dates and considering the dubious Late Palaeolithic record for the area, Collecchio repre-

Tab. 3 - Collecchio, actions and worked materials identified by use-wear analysis, divided according to the lithology of the blank (Ch – cherts; Rd – radiolarites; Lm/SC – limestones and spiculitic cherts; SI – siltstone). / Collecchio, azioni e materiali lavorati identificati tramite l'analisi funzionale, divisi in base alla litologia dei supporti (Ch – selci; Rd – radiolarite; Lm/SC – calcari e selci spicolitiche; SI – siltite).

| | Retouched blanks | Row blanks | Z.U. | Transversal action | Longitudinal action | Mixed action | Rotatory action | Undet. action | Hafting | Impact fracture | Hard material | Mid-hard material | Mid-soft material | Soft material | Undet. material | Wood | Soft animal tissue | Bone | Hide |
|-------|------------------|------------|------|--------------------|---------------------|--------------|-----------------|---------------|---------|-----------------|---------------|-------------------|-------------------|---------------|-----------------|------|--------------------|------|------|
| Ch | 42 | 28 | 64 | 34 | 19 | 3 | | 7 | 1 | 16 | 17 | 6 | 12 | 10 | 10 | 1 | 5 | | 3 |
| Rd | 6 | 21 | 30 | 15 | 12 | | 1 | 2 | | 1 | 7 | 4 | 3 | 2 | 3 | 4 | 6 | 1 | |
| Lm/SC | 3 | 2 | 5 | 5 | | | | | | | 5 | | | | | | | | |
| SI | | 3 | 3 | | 2 | | | 1 | | | 1 | | 2 | | | | | | |

sents the most ancient dated site of the southern Po Plain after the end of the LGM. In contrast with data documented both for the southern Alps and the Tuscan Apennines, where re-colonization after the LGM can be traced back to the Late Glacial, Collecchio attests that the first settlement of the Southern Po Plain by the last prehistoric hunter-gatherers started at least in the early Preboreal. This late settlement may represent a consequence of biased preservation of the archaeological record or reflect the real state of occupation of the area. In both cases, it is likely that environmental circumstances have played an important role either by avoiding visibility and/or causing destruction of former traces or by discouraging human occupation in the phases that preceded the Holocene. At any rate, starting from the Early Preboreal the hilly terraced areas of the Northern Apennines, where Collecchio is located, were favourable to human settlement, as it is well attested by palaeo-environmental data.

Concerning the subsistence of groups, besides the presence of faunal remains, which refer to a rather wide range of species, some hazelnuts represent the first evidence of the collection of spontaneous fruits by Early Mesolithic groups in the southern sector of the Po plain. The occurrence of edible land shells (*Cepaea* cf. *nemoralis* and *Ceruella* cf. *Cisalpine*) is also interesting although the lack of concentration areas for the latter, unfortunately, does not allow advancing any hypothesis on their possible role in the diet of the Mesolithic groups of Collecchio. At a more general level, being at the contact between two distinct landscape units, the prehistoric inhabitants settled in the area could exploit the resources offered by two different environments: the alluvial fan to the south (and the Taro valley further south) and the alluvial plain of the Po to the north, with its sizable biomass.

The results obtained from this multidisciplinary study indicate that the settlement model recognized for the Mesolithic of the Southern Po plain area had already developed since the mid Preboreal and was based on the exploitation of the resources offered by the local Apennines drainage systems. In particular, analysis of lithic raw materials from Collecchio suggests displacements between the foothill and the mid-high Apennines, covering an area spanning from the Trebbia valley (Piacenza) to the west to the Baganza valley (Parma) to the east. These data match with information coming from researches carried out in the mountain territories of the Emilia Apennines which, although in most cases lacking a radiocarbon chronology, indicate an intense exploitation of these areas by the Sauveterrian groups (Biagi *et al.* 1980; Fontana *et al.* 2013; Ghirelli & Fontana in press; Cipriani *et al.* 2001).

Within this system the site of Collecchio, located at the far edge of the alluvial fan of the river Taro, a right tributary of the river Po, could represent a seasonal base camp of mid-term duration, oriented towards different subsistence activities as attested by the prevailing role of tools and especially of burins over microliths (Visentin *et al.* 2014). This aspect together with evidence of several traces of transversal actions on hard materials (particularly wood) both on burins and on other categories of tools (truncations, flakes with an abrupt retouch, scrapers and denticulates) and unmodified blanks makes Collecchio a unique site in the Italian context for the early Mesolithic. Its functional role seems therefore complementary to that of most of the other known deposits of the Po plain area (I.N.F.S., Casalecchio, some loci at Le Mose) which show features that are more typical of short-term hunting stands (Fontana *et al.* 2009b; Visentin & Fontana 2016).

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F.F. wrote the Introduction; F.F. and D.E.A. wrote the Regional setting; D.E.A. and D.V. wrote The site of Collecchio: geographical, environmental and chronological context; M.P. and M.L. wrote Malacofaunal remains; M.M., S.M. and E.R. wrote Charcoal and carpological analysis; U.T.H. wrote Faunal remains; S.B. and D.V. wrote Lithic raw material provisioning; D.V. and F.F. wrote

The lithic assemblage and Spatial analysis; G.B., S.Z. and D.V. wrote Use-wear analysis; F.F. and D.V. wrote the Discussion; all the authors wrote the Conclusions. F.F. and D.V. have coordinated the work.

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References

- Accorsi C. A., Bandini Mazzanti M., Mercuri A. M., Rivalenti C. & Trevisan Grandi G., 1996 - Holocene forest pollen vegetation of the Po plain, Northern Italy (Emilia Romagna data), *Allionia. Bollettino del Dipartimento di Biologia Vegetale dell'Università di Torino*, 34: 233-276.
- Accorsi C. A., Bandini Mazzanti M., De Biasi B., Mercuri A. M. & Trevisan Grandi G., 2000a - The Holocene pollen history of Castanea in Emilia Romagna (Northern Italy). In: W., Wang, S., Ouyang, X., Sun, G., Yu (ed.), *Abstracts of the 10th International Palynological Congress (Nanjing, China; June 24-30 2000)*: 4-5.
- Accorsi C. A., Bandini Mazzanti M., Forlani L., Mercuri A. M. & Trevisan Grandi G., 2000b - An overview of Holocene forest pollen flora/vegetation of the Emilia Romagna region, Northern Italy. In: A. Pirola (ed.), *Contributi alla valutazione dell'impatto ambientale con indicatori floristici e vegetazionali*, *Archivio Geobotanico* 5 (1999), 1-2: 3-27.
- Bandini Mazzanti M., Mercuri A. M., Trevisan Grandi G. & Accorsi C. A., 2000 - Le vicende oloceniche di Castanea in Emilia Romagna (Nord Italia) in base ai documenti pollinici. In: M. G. Bertani, M. Piaccarelli (ed.), *Problematiche di Biologia Vegetale in Ambiente Mediterraneo, 95° Congresso Società Botanica Italiana, Messina 28-30 Settembre 2000*: 174.
- Bedulli F. & Valloni R., 2004 - Struttura fisica della conoide alluvionale gigante del fiume Taro e ricarica degli acquiferi della pianura parmense. *Il Quaternario – Italian Journal of Quaternary Science*, 17: 303-312.
- Beyries S., 1987 - *Variabilité de l'industrie lithique au moustérien : approche fonctionnelle sur quelques gisements français*. BAR International Series 328.
- Biagi P., Castelletti L., Cremaschi M., Sala B. & 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.
- Broglio A., 1980 - Culture e ambienti della fine del Paleolitico e del Mesolitico nell'Italia nord-orientale. *Preistoria Alpina*, 16: 7-29.
- Busacca A. & Cremaschi M., 1998 - The role of time versus climate in the formation of deep soils of the Apennine Fringe of the Po valley, Italy. *Quaternary International*, 51/52: 95-107.
- Christensen M., 1996 - *Le travail et l'usage de l'ivoire au Paléolithique supérieur. Tracéologie des outils en silex et caractérisation chimique des polis d'utilisation*. PhD Thesis, Université de Paris I – Panthéon-Sorbonne.
- Cipriani N., Dini M., Ghinassi M., Martini F. & Tozzi C., 2001 - L'approvvigionamento della materia prima in alcuni tecnocomplessi della Toscana appenninica. *Rivista di Scienze Preistoriche*, LI: 337-388.
- Cossignani T. & Cossignani V., 1995 - *Atlante delle conchiglie terrestri e dulciacquicole italiane*. L'Informatore Piceno, Ancona.
- Cremaschi M., 1985 - Situazione stratigrafica e paleoambientale del Mesolitico nel territorio bolognese. In: Lenzi F., Nenzioni G., Peretto C. (Eds.), *Materiali e documenti per un museo della Preistoria. S. Lazzaro di Savena e il suo territorio*. Nuova Alfa Editoriale, S. Lazzaro di Savena: 195-198.
- Cremaschi M., 1987 - *Paleosols and vetusols in the Central Po Plain (Northern Italy)*. Unicopli, Milano.

- Cremaschi M., 1990 - Pedogenesi medio olocenica ed uso dei suoli durante il Neolitico in Italia Settentrionale. In: Biagi P. (Ed.), *The neolithisation of the Alpine Region*. Monografie di Natura Bresciana, 13: 71-89.
- Cremaschi M., Biagi P., Castelletti L., Leoni L., Accorsi C., Mazzanti M. & Rodolfi G., 1984 - Il sito mesolitico di Monte Bagioletto, nel quadro delle variazioni ambientali oloceniche dell'Appennino Tosco - Emiliano. *Emilia Preromana*, 9: 11-46.
- Cremaschi, M., Guerreschi A. & Steffé G., 1990 - Il sito mesolitico di Cava Due Portoni a Borgo Panigale (Bologna). In: Iodice M. (Ed.), *Borgo Panigale. Da villaggio mesolitico a quartiere cittadino*. CRABP, Bologna: 11-20.
- Cremonini S., 1987 - Alcuni problemi ed idee di geologia del Recente relativi all'alta pianura bolognese. In: Bermond Montanari G. (Ed.), *La stratigrafia del Tribunale nuovo di Bologna, "La formazione della città in Emilia Romagna, Catalogo della Mostra, XI Biennale d'Arte antica, (Studi e Documenti di Archeologia III)*. Bologna: 49-61.
- Cusinato A., Dalmeri G., Fontana F., Guerreschi A. & Peresani M., 2003 - Il versante meridionale delle Alpi durante il Tardiglaciale e l'Olocene antico: mobilità, sfruttamento delle risorse e modalità insediative degli ultimi cacciatori-raccoglitori. *Preistoria Alpina*, 39: 129-142.
- Cziesla E., 1990 - On refitting of stone artefacts. In: Cziesla E., Eichhoff S., Arts N., Winter D. (Ed.), *The Big Puzzle. International Symposium on Refitting Stone Artefacts*. Holos, Bonn: 9-44.
- Elter P. & Marroni M., 1991 - Le Unità Liguri dell'Appennino Settentrionale: sintesi dei dati e nuove interpretazioni. *Memorie Descrittive della Carta Geologica d'Italia*, 46: 121-138.
- Farabegoli, E., F. Fontana, A. Guerreschi & G. Nenzioni, 1994. "Il sito mesolitico dell'I.N.F.S. di Colunga (Ozzano Emilia - Bologna)", *Bullettino di Paletnologia Italiana* 85: 73-133.
- Ferreri D., 1994 - Contributo alla conoscenza della malacofauna della Riserva Naturale "Le Cesina" (Lecce). *Thalassia Salentina*, 20: 67-75.
- Fisher A., Vemming Hansen P. & Rasmussen P., 1984 - Macro and Microwear Traces on Lithic Projectile Points. Experimental results and prehistoric examples. *Journal of Danisch Archaeological*, 3: 19-46.
- Fontana F., 2011 - De saison en saison : réévaluation du statut fonctionnel des habitats sauveveterriens du secteur nord oriental de la péninsule italienne et implications sur la mobilité des groupes humains. In: Bon F., Costamagno S., Valdeyron N. (Ed.), *Haltes de chasse en préhistoire : quelles réalités archéologiques ? Actes du Colloque International, 13-15 Mai 2009*. Université de Toulouse II Le Mirail, Laboratoire Travaux et Recherches Archéologiques sur les Cultures, les Espaces et les Sociétés, Palethnologie, 3 : 295-312.
- Fontana F. & 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., Araujo M.C., Tiffagom M. (Eds.), *Typology vs Technology. Proceedings of the XV U.I.S.P.P. Congress, Lisbona, 3-9 settembre 2006, vol 21, session C65*. BAR. International Series 1831: 207-214.
- Fontana F. & 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.B., Schulting R., Warren G., Woodman P. (Ed.), *Mesolithic horizons, Papers presented at the 7th International Conference on the Mesolithic in Europe, Belfast, Northern Ireland, 29 august-2 september 2005*. Oxbow Books, Oxford, vol. I: 802-810.
- Fontana F. & Visentin D., 2016 - Between the Venetian Alps and the Emilian Apennines (Northern Italy): Highland vs. lowland occupation in the early Mesolithic. *Quaternary International*, in press. <http://dx.doi.org/10.1016/j.quaint.2015.12.014>
- Fontana F., Cremona M.G., Cavallari P., Gazzoni V. & Nenzioni G. 2009a - Variability of lithic technical systems in the Sauveterrian of the Southern Po Plain. *Human Evolution*, 24/2: 153-164.
- Fontana F., Cremona M.G., Ferrari E., Guarisco F. & Mengoli D., 2009b - People and their land at the southern margins of the central Po Plain in the Early Mesolithic In: McCartan S.B., Schulting R., Warren G., Woodman P. (Ed.), *Mesolithic horizons, Papers presented at the 7th International Conference on the Mesolithic in Europe, Belfast, Northern Ireland, 29 august-2 september 2005*. Oxbow Books, Oxford, vol. I: 296-302.
- Fontana F., Govoni L., Guerreschi A., Padoanello S., Siviero A., Thun Hohenstein U. & Ziggliotti S., 2009c - L'occupazione sauveveterriana 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., Guerreschi A., Peresani M., 2011 - The visible landscape. Inferring Mesolithic settlement dynamics from multifaceted evidence in the south-eastern Alps. In: Van Leusen M., Pizziolo G., Sarti E. (Ed.), *Hidden landscapes of Mediterranean Europe. Cultural and methodological biases in pre- and protohistoric landscape studies. Proceeding of the International Conference, Siena, 25-27 May 2007*. BAR International Series 2320, Archaeopress: 71-81.
- Fontana F., Ferrari S. & Visentin D., 2013 - A review on the Mesolithic of the Emilian Apennines and Po Plain. *Preistoria Alpina*, 47: 17-30.
- Fontana F., Cavallari P., Mengoli D. & Visentin D., in press - I cacciatori sauveveterriani della pianura bolognese. *Preistoria e Protostoria dell'Emilia Romagna*, Studi di Preistoria e Protostoria, 3.
- 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 Editions.
- Ghiretti A., 2003. *Preistoria in Appennino. Le valli parmensi di Taro e Ceno*. Grafiche STEP Editrice, Parma.
- Ghiretti A. & Fontana F., in press - Siti mesolitici dell'Appennino Parmense - Piacentino nella collezione Osvaldo Baffico. *Preistoria e Protostoria dell'Emilia Romagna*, Studi di Preistoria e Protostoria, 3.
- Ghiretti A. & Guerreschi A., 1988 - Il Mesolitico nelle Valli di Taro e Ceno (Parma). *Preistoria Alpina*, 24: 69-102.
- Giusti F. & Castagnolo L., 1982 - I molluschi terrestri delle dune italiane: brevi cenni di ecologia, elenco delle specie e chiavi per il loro riconoscimento. *Quaderni sulla struttura delle zoocenosi terrestri 3. Ambienti terrestri, 1. Le coste sabbiose*: 51-102.
- Keeley L.H., 1980 - *Experimental determination of stone tools uses; a microwear analysis*. The University of Chicago Press, Chicago and London.
- Kerney M. P. & Cameron R.A.D., 2006 - *Guide des escargots et limaces d'Europe*, Les Guides du Naturaliste. Delachaux et Niestle SA, Paris.
- Kozłowski S.K., Tozzi C., Cremaschi M. & Dini M., 2003 - L'industria di Isola Santa in Toscana e la sua posizione nel Sauveterriano italiano. *Rivista di Scienze Preistoriche*, LIII: 193-239.
- Krebs P., Conedera M., Pradella M., Torriani D., Felber M. & Tinner W., 2004 - Quaternary refugia of the sweet chest (Castanea sativa Mill.): an extended palynological approach. *Vegetation History and Archaeobotany*, 13: 145-160.
- Lazzari G., 2007 - *Cento Conchiglie del Parco. Guida alla Malacofauna del Parco del Delta del Po*. Longo Editore, Ravenna.
- Lemorini C., 2000. *Reconnaître des tactiques d'exploitation du milieu au Paléolithique Moyen. La contribution de l'analyse fonctionnelle. Étude fonctionnelle des industries lithiques de Grotta Breuil (Latium, Italie) et de la Combette (Bonnieux, Vaucluse, France)*. BAR International Series, 858.
- Manganelli G., Bodon M., Favilli L. & Giusti F., 1995 - Gastropoda Pulmonata. In: Minelli A., Ruffo S., La Posta S. (Ed.), *Checklist*

- delle specie della fauna d'Italia, 16.
- Marchesini M., Gobbo I. & Marvelli S., in press - Il paesaggio vegetale e l'ambiente nel mesolitico nella pianura emiliana. *Preistoria e Protostoria dell'Emilia Romagna*, Studi di Preistoria e Protostoria, 3.
- Moss E.H., 1983 - *The functional analysis of flint implements. Pincevent and Pont d'Ambon: two case studies from the French Final Palaeolithic*. BAR International Series 177.
- Odell G.H., 1981 - The mechanism of use-breakage of stone tools. some testable hypothesis. *Journal of Field Archaeology*, 8: 197-209.
- Paganelli A. & Miola A., 1991 - Chestnut (*Castanea sativa* Mill.) as an indigenous species in Northern Italy. *Il Quaternario*, 4: 99-106.
- Pawlik F.A., 2011 - Die funktionale Analyse der Steingeräte und Rekonstruktion der Aktivitäten am Ullafelsen. In: Schaefer D. (Ed.), *Das Mesolithikum-Projekt Ullafelsen (Teil 1)*, Mensch und Umwelt im Holozän Tirols Band 1. Zabern Philipp von GmbH, Innsbruck: 355-459.
- Peresani M., Ferrari S., Miolo R. & Ziggiotti S., 2009 - Il sito di Casera Lissandri 17 e l'occupazione sauveterriana del versante occidentale di Piancansiglio. In: Peresani M. and Ravazzi C. (Eds.), *Le Foreste Dei Cacciatori Paleolitici. Ambiente e Popolamento Umano in Cansiglio Tra Tardoglaciale e Postglaciale*. Pordenone, 199-227.
- Philibert S., 2002 - Les derniers "Sauvages": territoires économiques et systèmes techno-fonctionnels mésolithiques. BAR International Series, 1069, Archaeopress, Oxford.
- Pignatti S., 1982 - *Flora d'Italia*, Bologna.
- Plisson H., 1985 - *Etude fonctionnelle d'outillages lithiques préhistoriques par l'analyse des micro-usures : recherche méthodologique et archéologique*. Unpublished PhD thesis, Université de Paris I – Panthéon-Sorbonne.
- Reimer P. J., Bard E., Bayliss A., Beck J. W., Blackwell P. G., Bronk Ramsey C., Grootes P. M., Guilderson T. P., Haffidason H., Hajdas I., Hatte 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. & van der Plicht J., 2013 - IntCal13 and Marine13 Radiocarbon Age Calibration Curves 0-50,000 Years cal BP. *Radiocarbon*, 55: 1869-1897.
- Rots V., 2002. *Hafting traces on flint tools. possibilities and limitations of macro and microscopic approaches*. Unpublished PhD thesis, Katholieke Universiteit Leuven.
- Tozzi C., 2000. Il popolamento della Toscana nel Paleolitico Superiore e nel Mesolitico. In: Tozzi C., Weiss M.C. (Eds.), *Il Primo Popolamento Olocenico Dell'area Corso-Toscana*: 15-22.
- Tringham R., Cooper G., Odell G.H., Voytek B. & Whitman A., 1974 - Experimentation in the formation of edge damage: A new approach to lithic analysis. *Journal of Field Archaeology*, 1: 171-196.
- Vaughan P., 1985 - *Use-wear analysis of flaked stone tools*. The University of Arizona Press, Tucson.
- Visentin D. & Fontana F., 2016 - An intra-site perspective on the Sauveterrian lowland occupation of the Emilian Po plain (Northern Italy). *Quaternary International*, in press. <http://dx.doi.org/10.1016/j.quaint.2015.11.104>
- Visentin D., Fontana F., 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., Bertola S., Ziggiotti S. & Peresani M., 2016 - 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*, in press. <http://dx.doi.org/10.1016/j.quaint.2015.11.119>