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## Technological continuity and discontinuity in the Romagnano Loc III rock shelter (NE Italy) Mesolithic series

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### ABSTRACT

This paper reports results of a technological study carried out on the lithic assemblages of the Mesolithic sequence of Romagnano rock shelter, in the south-eastern Alps, which represents the reference site for the Sauveterrian and Castelnovian of northeastern Italy. Considering the technical differences between the two phases, this work has tried to ascertain aspects of continuity and discontinuity within this series in the aim of investigating the way this transition occurred – abrupt or progressive. The objectives of *débitage* and the techniques applied, along with the reductions sequences and the methods involved, have been reconstructed. In order to interpret these data, a comparison with other main Castelnovian assemblages of the Italian peninsula has been carried out. Results attained indicate that the major changes occurred at the transition between I and II Mesolithic are closely related to the introduction of new knapping techniques – indirect percussion/pressure. The persistence of some characters derived from the more ancient pragmatic Sauveterrian tradition has also been highlighted. The existence of a real progressive transition seems difficult to be proved considering that Romagnano, as other continuous series available from other rock shelters of the peninsula, could have undergone problems of stratigraphic disturbance.

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### 1. Introduction

One of the most relevant aspects of the Mesolithic is the evident technological shift that differentiates lithic assemblages from the ancient and recent phases of this period. This is not only a peculiar feature of the transition between the Sauveterrian and the Castelnovian in southwestern Europe, but it represents a wider phenomenon known at a European level which stands as the main element of the distinction between the ancient and the recent Mesolithic (for French authors, I and II Mesolithic) (Perrin et al., 2009; Ferrari et al., 2010; Franco, 2011; Binder et al., 2012; Marchand, 2014). Although less investigated than the boundary between the Mesolithic and the Neolithic, this change is substantial in relation to the relevance of the technical modifications that lithic systems have undergone. It is now recognized that the major aspects of this change are closely related to the introduction of new knapping techniques (indirect percussion and pressure) enabling to

obtain extremely regular laminar and lamellar products. These modifications also involved the development of a new technical concept of microlithic armature – the trapeze – obtained from the transversal segmentation of lamellar blanks (frequently by the application of the microburin technique) keeping the lateral margins of the blades unaltered. At the same time it deeply affected the morphology and variety of common tools with the development of the typical denticulated bladelets (Montbani bladelets) as well as of long end-scrapers. A break was thus created with the previous Early Mesolithic technology directly derived from the Late Palaeolithic one in which the morphology of blanks was irrelevant in relation to the complete transformation they underwent during the production of microlithic armatures (Sauveterre points, triangles, crescents).

This phenomenon is mainly known from the point of view of the morphology of final products and the techniques applied while there is less awareness on how reduction sequences have changed through time from one period to the other. Namely one of the open questions of the transition concerns the permanence in the assemblages of the II Mesolithic, of technical features directly derived from the most ancient tradition, an aspect that is also important in

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terms of definition of the modality this shift occurred, i.e. abrupt or progressive. The most evident aspect of a possible continuity stands in the presence within Castelnovian assemblages of some typical early Mesolithic armatures. As far as the Italian peninsula is concerned, this aspect is considered by some authors as an evidence of a progressive transition (Franco, 2011) while others support that it is a consequence of post-depositional processes (Perrin, 2006). Although functional analyses are still few, the diffusion of trapezes in the II Mesolithic seems to suggest their flexible use both as penetrating points and barbs, thus implying the possibility of a total replacement of the typical early Mesolithic armatures (Perrin et al., 2009).

In order to discuss this question, results of a technological study carried out on the lithic assemblage from the Mesolithic series of Romagnano Loc III rock shelter (Trentino, North-Eastern Italy) are presented. An analysis of the technical systems adopted by Mesolithic knappers has been carried out, focusing on their diachronic evolution.

## 2. Mesolithic series of Romagnano

### 2.1. Stratigraphy

Romagnano Loc III rock shelter is located in the south-eastern Alps on the right side of the Adige valley, at an altitude of 210 m (Fig. 1). It contains a thick stratigraphic series spanning from the Mesolithic to the Iron age (Boscato et al., 1992). The Mesolithic sequence, excavated between 1971 and 1973 by A. Broglio, develops over a thickness of about 200–250 cm (Fig. 2) (Broglio, 1971, 1972, 1973, 1996). The lowermost layers are mostly composed of clasts (AF and AE) and are covered by archeologically sterile alluvial gravel deposits (layer AD) altered at the top by a fireplace. Sedimentation processes change in the uppermost layers (AC, AB and AA) which are mainly composed of fine carbonate sediments with a few coarser components (Boscato and Sala, 1980). AC9 is a transitional level between AD and AC8 while layers AC8 to AC4 record a long-term phase of superimposed anthropogenic sedimentary events. These layers are separated from AC3–AC1 by a stratigraphic discontinuity. AB3 to AB1 are arbitrary layers actually belonging to the same stratigraphic unit. The same holds for layers AA2 and AA1 (Broglio pers. com.), the latter of which contained some Neolithic potsherds.

The lower part of the sequence encloses a Sauveterrian assemblage which has been divided into three phases (AF–AE, AC9–3 and AC2–1), respectively early, middle and late, while the Castelnovian layers include an early (AB1–3) and a late phase (AA1–2). AB3 is considered a reworked layer (Broglio and Kozłowski, 1983). Several dating are available for the series as illustrated in Table 1 (Stuiver and Reimer, 1993). The Sauveterrian sequence extends between  $9830 \pm 90$  BP and  $8220 \pm 70$  BP (11,618–9016 cal BP); the Castelnovian one between  $8140 \pm 80$  BP and  $6480 \pm 50$  BP (9399–7280 cal BP).

### 2.2. Typological aspects

A typological study has been carried out in the early 1980s, the results of which are here briefly summarized (Broglio and Kozłowski, 1983). Both in the Sauveterrian and the Castelnovian microliths prevail over tools (58.9–72% and 54.8–60.3% respectively) with the exception of layer AC5 (40.7%).

The tool structure is dominated by end-scrapers followed by retouched flakes in the Sauveterrian and retouched blades (notches and denticulated) in the Castelnovian. Backed knives are rare and only present in the Sauveterrian sequence. End-scrapers are produced both on laminar blanks or flakes in the Sauveterrian, while in

the Castelnovian they are mainly on blades. Burins show a typological continuity along the sequence with some peculiarities in the two phases.

Microliths reflect more important trends. In the Sauveterrian triangles (49.2% in AC3), double backed (cf. Sauveterrian) points (47.0% in AC5) and crescents (27.2% in AC 8–9) dominate, while in the Castelnovian trapezes (61.1% in AB1–2 e 88.2% in AA) are the best represented group. Triangles (12.5–2.6%) and double backed points (11.8–3.3%) continue to be present in the Castelnovian levels although with a decreasing trend while the other Sauveterrian types are very rare.

## 3. Techno-economical analysis

### 3.1. Presentation of the lithic assemblages

All the cores from the Mesolithic series have been analyzed, while the other technological categories have been selected on a topographic base (4alfa and 5alfa squares). The amount of analyzed items divided by categories and considered for each separated phase is illustrated in Table 2. Technological data on the Sauveterrian sequence have been presented in a previous paper (Flor et al., 2011). Lithic raw materials are constituted by flints exposed in the surrounding area where they are embedded in the limestones under a wide variety of shapes (nodules, lenses and beds) and features (colour, texture, etc.) but also contained in the slope and alluvial deposits. In the middle-low Adige valley and the western Lessini Mountains the most diffused types are those of the Scaglia Rossa and Maiolica (formerly called Biancone) formations (Avanzini et al., 1998; Peresani and Bertola, 2009). These types are also the most diffused in the Romagnano III sample followed by Scaglia Variegata. Determination of raw materials has been carried out on the basis of macroscopic evaluations by comparing geological to archaeological samples. In the Sauveterrian and the early Castelnovian (AB1–3) Scaglia Rossa represents the most common raw material in terms of number of elements (followed by Maiolica, formerly called Biancone), while in the recent Castelnovian (AA1–2) the rate between the two is reversed. Flint supply occurred mainly within regolith and slope deposits, although in the Castelnovian some pebbles were also provisioned along stream beds (Flor et al., 2011; Fontana et al., in press-a).

### 3.2. Cores reduction methods

In order to detect cores reduction methods *débitage* surfaces and striking platforms were analyzed. Multiple *débitage* surfaces dominate in the ancient Sauveterrian and decrease over time, although with an irregular trend. Consequently, single *débitage* surfaces reach their highest value in the recent Sauveterrian and suffer a weak decline in the Castelnovian, where they remain the most frequent (Table 3).

As to striking platforms, single types show low values in the Sauveterrian (21.1–28.6%) and an increase in the Castelnovian (38.6–44.5%) corresponding to an important decrease of double and multiple striking platforms from the Sauveterrian (52.4–38.9% and 15.5–14.3%) to the Castelnovian (26.3–25.9% and 12.3–7.4%). Peripheral platforms keep low values all along the series with the highest peaks in the middle Sauveterrian and the recent Castelnovian (10.2–11.1%) (Table 4). In both phases, peripheral (centripetal) cores tend to be exploited for flakes production while single, double and multiple striking platform cores are aimed at the production of elongated elements (bladelets and laminar flakes).

Comparing data from the number of surfaces and platforms on the cores, we may infer an increase of unidirectional exploitation in



**Fig. 1.** Location of the site of Romagnano Loc III in the south-eastern Alps.

the Castelnovian associated to both single and multiple adjacent surfaces. By contrast, reorientation processes are more frequent in the Sauveterrian and decrease through time although they never disappear.

### 3.3. Cores reduction techniques

In the Sauveterrian, the use of direct percussion is almost exclusive with a few cases of reduction by bipolar technique (4.2%). In the Castelnovian the variety of knapping techniques

increases with the introduction of indirect percussion and pressure (Fig. 3). Based on the current literature, identification of knapping techniques has been carried out by analysing diagnostic features on the cores and the proximal parts of bladelets. Particularly the morphology of striking platforms and butts have been considered along with *angles de chasse* (Pelegrin, 1988; Inizan et al., 1995; Gallet, 1998; Briois et al., in press). Plain and/or faceted platform/butts with *angles de chasse* of around 90° have been considered as typical of indirect percussion/pressure while punctiform and linear butts have been attributed to direct

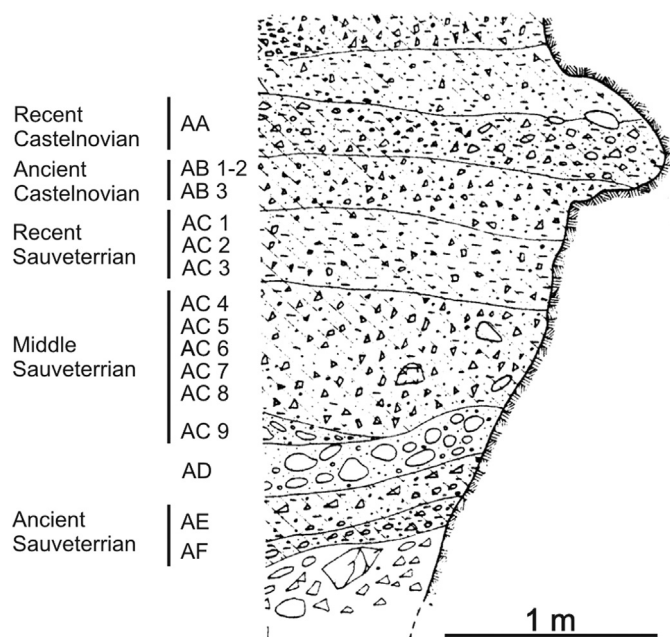


Fig. 2. Romagnano Loc III Mesolithic stratigraphy (revised from Broglio and Kozłowski, 1983).

percussion with a soft hammer-stone. In the absence of an experimental program carried out on the Romagnano assemblage, we have chosen not to differentiate elements possibly obtained with either indirect percussion or pressure, although general comparisons with other assemblages allow us to advance the hypothesis that both techniques were applied (Perrin, 2006; Briois et al., in press). No elements presenting characters that could indicate the use of either indirect percussion or pressure were detected within the Sauveterrian sequence. All along the sequence, we observe the persistence of direct percussion and a progressive increase of cores flaked by pressure/indirect percussion. The presence of cores exploited with either indirect percussion or pressure in the *plein débitage* phase and by direct percussion technique in their last phase is also observed both in the ancient and recent Castelnovian while bipolar technique is still present in the ancient Castelnovian and disappears in the recent phase.

### 3.4. Débitage objectives

*Débitage* objectives have been investigated through the typometrical analysis of the negatives of the last removals on cores and of first intention blanks. The analysis of the negatives on cores indicates a continuous cluster for the Sauveterrian with production spanning from large flakes to narrow bladelets (Fig. 11a–e) while in the Castelnovian microbladelets (Fig. 11f) become dominant over laminar flakes and flakes and two clusters are identified: one including elements under 25 mm of length and the other one with items of length between 29 and 36 mm. The second cluster is characterized by very standardized width ( $11 \pm 2$  mm) (Fontana et al., in press-a) (Figs. 4 and 5).

The typometrical analysis of unmodified lamellar blanks has allowed the identification of two main dimensional classes for both phases: the first class is represented by microbladelets (lengths between 10 and 35 mm) and the second one by bladelets (lengths between 36 and 53 mm). Only one laminar blank in the Castelnovian overpasses 60 mm of length. In both phases the width range of microbladelets increases progressively according to length while it appears quite wide for bladelets in the Sauveterrian (11–23 mm) and rather standardized in the Castelnovian ( $11 \pm 2$  mm) (Figs. 6 and 7).

Focusing our attention on lamellar blanks from the Castelnovian layers, two classes are identified: the first one is produced by direct percussion and the second one by indirect percussion/pressure. We can observe a progressive decrease in the presence of lamellar blanks produced with direct percussion technique during the Castelnovian (Fig. 8). Comparing the dimensional parameters of Castelnovian lamellar blanks obtained with different techniques, the following differences can be observed: bladelets removed by direct percussion tend to be shorter and narrower while among blanks obtained by indirect percussion/pressure longer modules prevail and width appears very standardized focusing around 9–10 mm (Figs. 9 and 10); these bladelets are also characterized by a higher regularity of the dorsal ridges and edges. Analysis of thickness did not show any meaningful difference between the two techniques. Blanks with thickness of 2 mm are dominant for both techniques followed by 1 and 3 mm.

### 3.5. Blanks transformation

The selection of blanks for the manufacture of tools and microliths shows different patterns between the two Mesolithic phases. In the Sauveterrian, the use of a high variety of blanks is

Table 1

Cultural sequence of Romagnano Loc III with the list of available radiocarbon dates calibrated at  $2\sigma$  according to Stuiver and Reimer (1993) (version 5.0).

Cultural phases	Layer	Lab code	$^{14}\text{C}$ years BP	Dates cal BP	Dates cal BC
Recent Castelnovian (layers AA2–1)	AA1–2	R-1136	6480 $\pm$ 50	7478–7280	5528–5330
Ancient Castelnovian (layers AB3–1)	AB1–2	R-1137A	7500 $\pm$ 160	8596–7982	6646–6032
	AB1–2	R-1137B	7800 $\pm$ 80	8973–8413	7023–6463
	AB1–2	R-1137	7850 $\pm$ 60	8978–8481	7028–6531
Recent Sauveterrian (layers AC2–1)	AB3	R-1138	8140 $\pm$ 80	9399–8779	7449–6829
	AC1	R-1139	8220 $\pm$ 70	9404–9016	7454–7066
Middle Sauveterrian (layers AC9–3)	AC2	R-1140	8560 $\pm$ 70	9687–9443	7737–7493
	AC3	R-1141	8590 $\pm$ 70	9737–9467	7787–7517
	AC4	R-1142	8740 $\pm$ 90	10,151–9541	8201–7591
	AC5–6	R-1143a	9090 $\pm$ 90	10,511–9929	8561–7979
	AC7	R-1144a	9100 $\pm$ 90	10,518–9934	8568–7984
	AC8–9	R-1145	9200 $\pm$ 60	10,515–10,238	8565–8288
	AC8–9	R-1145a	9200 $\pm$ 60	10,515–10,238	8565–8288
Ancient Sauveterrian (layers AF–AE)	AE	R-1146B	9490 $\pm$ 80	11,122–11,119	9172–9169
	AE1–4	R-1146Aa	9580 $\pm$ 250	11,703–10,235	9753–8285
	AE1–5	R-1146a	9420 $\pm$ 60	11,065–10,445	9115–8495
	AF	R-1147	9830 $\pm$ 90	11,618–10,875	9668–8925

**Table 2**  
Composition of the studied sample from the Mesolithic series of Romagnano Loc III.

Technological category	Ancient Sauveterrian (layers AF–AE)	Middle Sauveterrian (layers AC9–3)	Recent Sauveterrian (layers AC2–1)	Ancient Castelnovian (layers AB3–1)	Recent Castelnovian (layers AA2–1)	Total
Retouched blanks	214	240	213	229	76	972
Microburins	197	240	112	283	96	928
Unretouched blanks	266	1650	630	1102	346	3994
Cores	23	167	72	58	27	347
Total diagnostic artifacts	700	2297	1027	1672	545	6241
Undet-burnt	1036	4130	1806	3296	610	10,878
Flakes < 1 cm	230	1833	1196	1340	310	4909
Total	1966	8260	4029	6308	1465	22,028

**Table 3**  
Organisation of flaking surfaces on cores in the Mesolithic series of Romagnano Loc III.

N. <i>débitage</i> surfaces on cores	Ancient Sauveterrian (layers AF–AE)		Middle Sauveterrian (layers AC9–3)		Recent Sauveterrian (layers AC2–1)		Ancient Castelnovian (layers AB3–1)		Recent Castelnovian (layers AA2–1)		Total	
	n°	%	n°	%	n°	%	n°	%	n°	%	n°	%
Single <i>débitage</i> surface	10	21.7	84	52.5	35	77.8	11	61.1	11	64.7	151	52.8
Multiple <i>débitage</i> surface	36	78.3	76	47.5	10	22.2	7	38.9	6	35.3	135	47.2
Total	46	100.0	160	100.0	45	100.0	18	100.0	17	100.0	286	100.0

observed, while lamellar and backed lamellar products are mostly, although not exclusively, selected in the Castelnovian.

For the Sauveterrian, triangles (Fig. 11g, h) and double backed points (Fig. 11l, j) have been analyzed in detail, being the most representative category of microliths. Considering the deep modifications of the original blanks both by length and width only thickness has been considered. Data indicate a selection based on the thinnest elements with some meaningful correlations for the two categories showing that triangles mostly are concentrated around 1 mm (55.6%) followed by 2 mm (42.7%) and double backed points around 2 mm (65%) followed by 1 mm (32.5%). For the Castelnovian trapezes (Fig. 11k, l) were considered indicating a selection of lamellar elements with thickness mostly of 2 mm (45%), followed by 3 mm (19%). In this case, being the widths maintained during transformation, these have also been considered ( $10 \pm 2$  mm). These measures are comparable with the dominating width recorded among bladelets produced by pressure/indirect percussion.

The most representative category of tools, both in the Sauveterrian and in the Castelnovian is that of end-scrapers (Fig. 11m, n). Comparing the width of end-scrapers from the two chronological phases, we may observe that Sauveterrian end-scrapers are larger (12–23 mm) than the Castelnovian ones (10–15 mm). Comparing thicknesses, we can observe the presence of thinner end-scrapers in the Castelnovian (2–4 mm) than in the Sauveterrian (3–8 mm). The width of Castelnovian retouched blades

(Fig. 11o–u) is concentrated between 9 and 14 mm, thickness between 2 and 4 and length between 30 and 69 mm. This category thus includes the longest blades within the assemblage. The presence of some of these tools on larger modules than those of unmodified blanks could be due to the introduction of end-products manufactured elsewhere. This evidence is compatible with that observed in the Castelnovian burial of Mondeval de Sora (Fontana et al., in press-b).

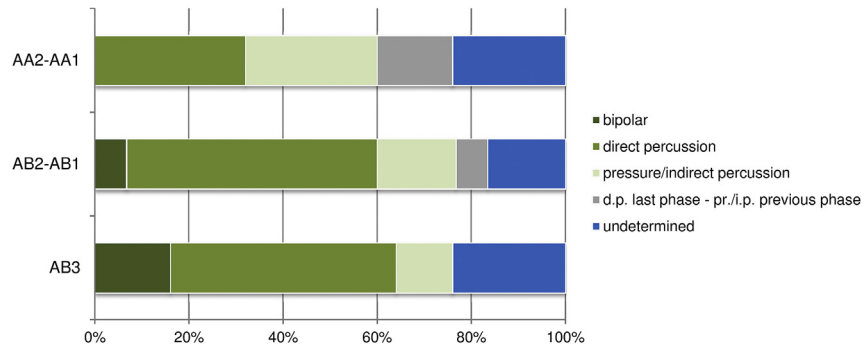
### 3.6. Reduction sequences

Two main reduction sequences have been identified both for the Sauveterrian and the Castelnovian (Fig. 12). The first one started from larger nodules/blocks (length of around 60 mm) and the second one from smaller ones and sometimes from thick flakes. The former was aimed at the production of bladelets followed by micro-bladelets and the second one of micro-bladelets and micro-flakes; the production of micro-flakes is much less frequent in the Castelnovian than in the Sauveterrian.

Some differences have been observed for each reduction sequence in relation to each phase (Sauveterrian and Castelnovian). The methods applied for the first scheme are more difficult to ascertain due to the lack of cores which were probably reduced further for the extraction of smaller modules. Nonetheless for the Castelnovian the regularity of bladelets width seems to evoke a rigid control of the advancement of *débitage* and the use of narrow

**Table 4**  
Organisation of striking platforms on cores in the Mesolithic series of Romagnano Loc III.

N. striking platforms on cores	Ancient Sauveterrian (layers AF–AE)		Middle Sauveterrian (layers AC9–3)		Recent Sauveterrian (layers AC2–1)		Ancient Castelnovian (layers AB3–1)		Recent Castelnovian (layers AA2–1)		Total	
	n°	%	n°	%	n°	%	n°	%	n°	%	n°	%
Single striking platform (unidirectional)	6	28.6	44	26.3	15	21.1	22	38.6	12	44.5	99	28.9
Double striking platform (bidirectional/orthogonal)	11	52.4	65	38.9	37	52.1	15	26.3	7	25.9	135	39.3
Multiple striking platform (multidirectional)	3	14.3	24	14.4	11	15.5	7	12.3	2	7.4	47	13.7
Peripheral striking platform (peripheral/centripetal)	1	4.7	17	10.2	3	4.2	4	7.0	3	11.1	28	8.2
Undetermined	0	0.0	17	10.2	5	7.1	9	15.8	3	11.1	34	9.9
Total	21	100.0	167	100.0	71	100.0	57	100.0	27	100.0	343	100.0



**Fig. 3.** Evolution of *débitage* techniques in the Castelnovian layers of Romagnano Loc III recorded by the analysis of cores. AB3 and AB2–1 have been separated due to possible occurrence of mixing processes in AB3 (AA1–2 n. 25, AB1–2 n. 30, AB3 n. 25).

faces with progressive platform rejuvenation and consequent reduction of the bladelets length. The use of indirect percussion/pressure would have facilitated this procedure. Possibly in the Sauveterrian reorientation occurred more frequently than platform rejuvenation.

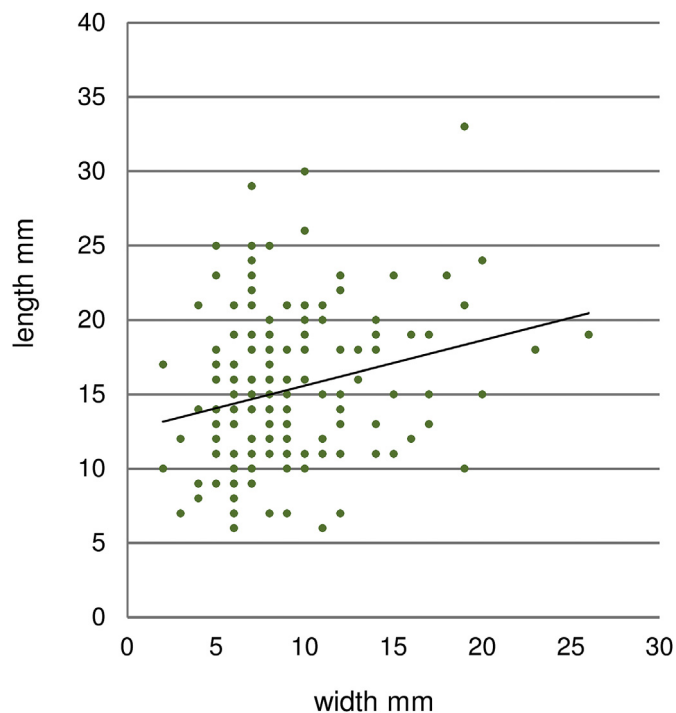
The second reduction sequence was carried out by three methods in the Sauveterrian: a) exploitation of the core edges (extraction of narrow bladelets) (Fig. 13e, g); b) exploitation of flat surfaces or frontal exploitation (extraction of larger bladelets) (Fig. 13a–d); c) exploitation of the ventral surfaces of large flakes (extraction of flakes) (Fig. 13d). Frequently the first two methods either evolved into a *semitournant* rhythm (Fig. 13f, h, i) or could imply core reorientation over new surfaces while the third one turned into a peripheral system (Fig. 13b) by reorientation on the same surface. All the schemes were applied by direct percussion with a soft hammer-stone.

In the Castelnovian frontal/facial reduction from one or two adjacent faces is the most frequently applied method (Fig. 14a, c)

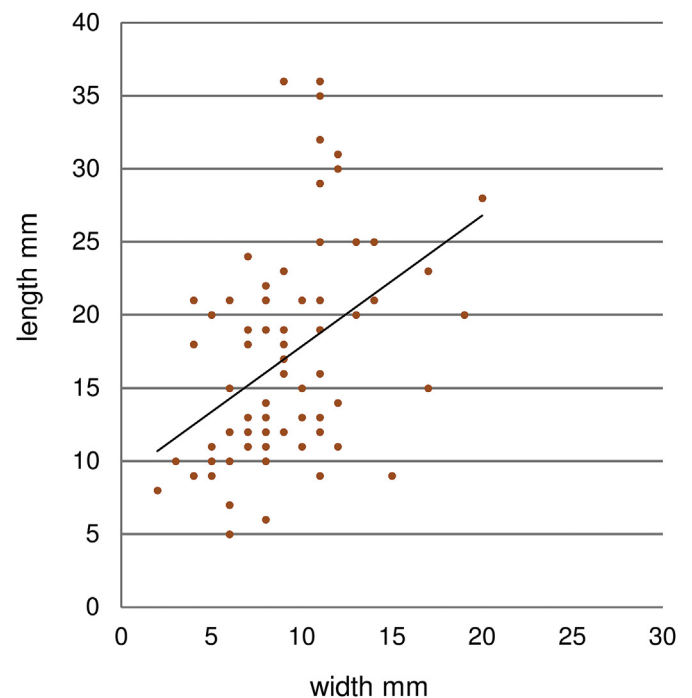
associated to on edge extraction of lamellar blanks (Fig. 14f–h). Both schemes may evolve into a *semi-tournant* exploitation (Fig. 14b, d, e). The most diffused techniques applied are indirect percussion/pressure although in the final stage of reduction the expedient extraction of lamellar flakes by direct percussion is documented. The third scheme (extraction of flakes from a peripheral platform) is less frequent and exclusively applied by direct percussion.

#### 4. Discussion: the Castelnovian assemblages of Northern Italy

In order to try to interpret results from the analysis of the lithic assemblages of Romagnano especially in terms of the changes occurred during the transition between the Sauveterrian and the Castelnovian, we have compared our data with those from other sites of the Italian peninsula. When investigating transitions within a complex stratigraphy one of the main problems consists in the possible presence of disturbance processes that may have caused a



**Fig. 4.** Dimensions of last removals on cores (n. 145) from the Sauveterrian layers of Romagnano Loc III.



**Fig. 5.** Dimensions of last removals on cores (n. 71) from the Castelnovian layers of Romagnano Loc III.

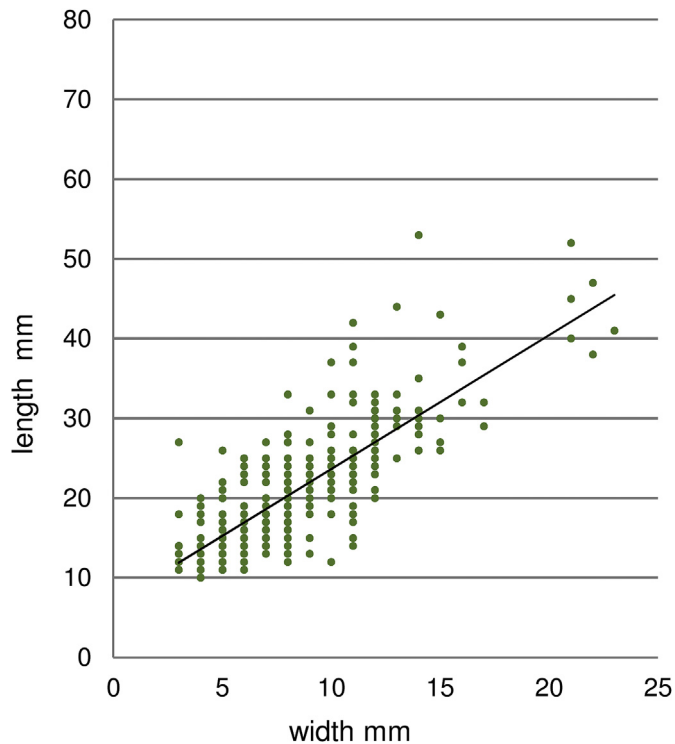


Fig. 6. Dimensions of lamellar blanks (n. 309) from the Sauveterrian layers of Romagnano Loc III.

mixing of elements from different phases. This is the case of Romagnano, especially of layer AB3.

The number of Late Mesolithic lithic assemblages known in the Italian peninsula is quite high, but only a few have been the object of technological analyses. Two of these are rock shelters

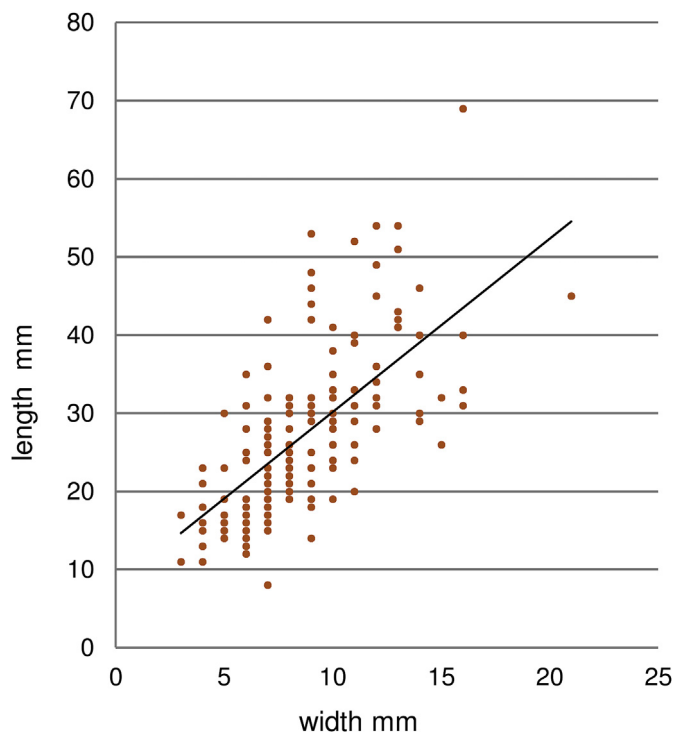


Fig. 7. Dimensions of lamellar blanks (n. 160) from the Castelnovian layers of Romagnano Loc III.

respectively located along the Adige valley not far from Romagnano (Gaban, Trentino) and in the central-southern Apennines at an altitude of 760 m a.s.l. (Latronico, Basilicata) while the third one is an open-air station (Lama Lite, Emilia) situated at 1700 m a.s.l. on the Tusco-Emilian Apennines. The Castelnovian layers of Gaban rock shelter are dated between  $8323 \pm 63$  BP,  $9472\text{--}9135$  cal BP (layer FA – Early Castelnovian) and  $6968 \pm 41$  BP,  $7927\text{--}7694$  cal BP (layer E – Late Castelnovian) and their lithic assemblages have been the object of two recent works (Kozłowski and Dalmeri, 2000; Perrin, 2006). Some stratigraphic problems affect the sequence of Gaban (Perrin, 2006). Latronico rock shelter contains five Late Mesolithic layers dated from  $8024 \pm 100$  BP to  $6970 \pm 90$  BP ( $9243$  to  $8038$  cal BP) while the Castelnovian occupation of Lama Lite is referred to the recent Castelnovian ( $6620 \pm 80$  BP,  $7720\text{--}7590$  cal BP) (Castelletti et al., 1976; Dini et al., 2008). Among all Castelnovian rock shelters, Latronico is the only one that does not overlie an early Mesolithic sequence.

At all the sites, cores indicate a unidirectional production of bladelets with a frontal reduction from one narrow or large face with some cases of *débitage* extending on the adjacent faces and the extraction of several parallel unipolar sequences of bladelets (Perrin, 2006; Dini et al., 2008; Dini and Fioravanti, 2011). At Latronico in their final exploitation stage, cores are sometimes characterised by the removal of flakes and laminar flakes. Both at Latronico and Lama Lite single platform cores (prismatic, pyramidal and sub-pyramidal) are associated to a few cores with two opposite or multiple platforms and to “discoidal” types for the production of laminar flakes and flakes. At Latronico, cores are flaked either by direct percussion or punch technique while at Lama Lite the main technique adopted is direct percussion although for the lamellar reduction sequence this technique is associated to soft hammer (organic) direct percussion, punch technique and pressure (Dini et al., 2008; Dini and Fioravanti, 2011). After Kozłowski and Dalmeri (2000), a techno-typological continuity is observed at Gaban among cores throughout the Mesolithic and Early Neolithic sequence with a progressive trend to replace “old” (discoidal) cores with “new” (bladelets) ones.

The metrical parameters recorded on lamellar blanks at Gaban (width:  $11 \pm 3$  mm and thickness:  $3 \pm 1$  mm) and Lama Lite (mean width: 10 mm; mean thickness 2.8 mm) are very similar to those of Romagnano (Perrin, 2006; Dini and Fioravanti, 2011). At Latronico, flakes are selected for the manufacturing of common tools (scrapers and retouched flakes) while bladelets are mostly modified into truncated tools and trapezes (trapezoidal arrowheads/microliths) (Dini et al., 2008).

As to the typological composition of the assemblages, evolutionary trends are observed at Gaban among armatures, namely a gradual disappearance of points on laminar flakes and crescents, a marked decrease of triangles (which persist in the Castelnovian, especially long types with a short base and three retouched sides) and a progressive increase of trapezes (reaching 84% in the Neolithic) while at Latronico almost all microliths are represented by trapezes with a dominance of symmetrical types on asymmetrical ones, which in most cases are not produced with the microburin technique (Kozłowski and Dalmeri, 2000; Dini et al., 2008). At Lama Lite (Dini and Fioravanti, 2011), among tools retouched blades dominate (44.2%) and they have sensibly bigger dimensions than other tools according to a pattern which has also been observed at Romagnano. Armatures are almost exclusively represented by trapezes (71), which are associated with 2 backed points and 1 backed truncated bladelet.

All other Castelnovian assemblages have been studied by a morpho-technological approach. Other rock shelters are found especially in north-eastern Italy but most known sites are open-air. Among rock shelters Pradestel is also located along the Adige valley,

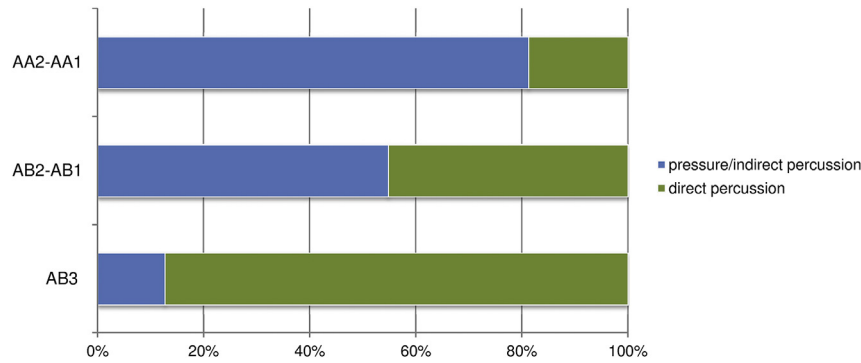


Fig. 8. Débitage techniques recorded on lamellar blanks from the Castelnovian layers of Romagnano Loc III (AA1–2 n. 64, AB1–2 n. 84, AB3 n. 63).

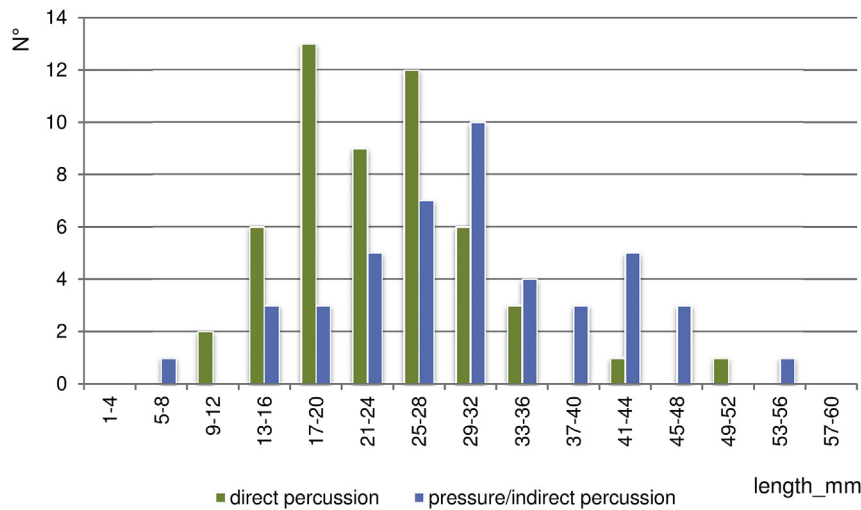


Fig. 9. Length classes of Castelnovian lamellar blanks of Romagnano Loc III divided on the basis of débitage technique (direct percussion n. 53, pressure/indirect percussion n. 45).

near Gaban and Romagnano. At this site Mesolithic layers are intercalated by sterile thin levels and – in the sequence – transition industries are present according to authors (Layer F – final Sauveterrian, layer E – early–middle Castelnovian and layer D – recent Castelnovian) with some Neolithic potsherds dated to  $6870 \pm 50$  BP,

7826–7611 cal BP (Dalmeri et al., 2008). In the final Sauveterrian layers (F<sub>2</sub>–F<sub>3</sub>) 4 trapezes are recorded while the Castelnovian sequence is characterised by a dominance of trapezes (87.0–33.3%) associated to some triangles and double backed points. In the Trieste Karst the Castelnovian layer (3a) of Edera Cave contains a

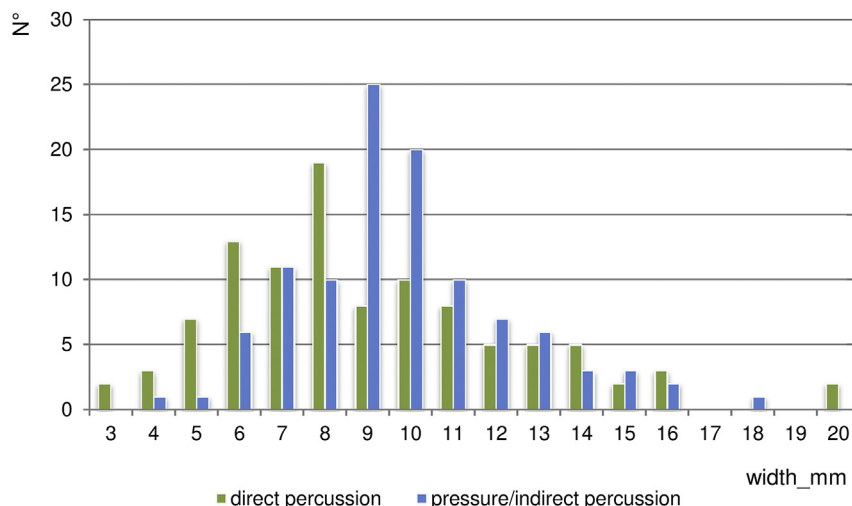


Fig. 10. Width classes of Castelnovian lamellar blanks of Romagnano Loc III divided on the basis of débitage technique (direct percussion n. 103, pressure/indirect percussion n. 106).





**Fig. 11.** Selection of *débitage* products, tools and microliths of Romagnano Loc III. Sauveterrian: a) large flake; b, c, d, e) narrow bladelets; g, h) triangles; i, j) double backed points; m) end-scraper. Castelnovian: f) microbladelet; k, l) trapezes) n) end-scraper; o, p, q, r, s, t, u) retouched blades and bladelets.

hearth (with a radiocarbon date of  $6700 \pm 130$  BP – 7825–7329 cal BP – very close to that of the above layer referred to the early Neolithic) which is associated to a Late Mesolithic flint assemblage accompanied by some potsherds (Biagi et al., 2008).

Among open air sites two deposits are located in the Lombard Alps: Laghetti del Crestoso (Bovegno, Brescia) in the upper Val Trompia, at an altitude of 2006 m a.s.l. (Baroni and Biagi, 1997) for which four radiocarbon dates are available ( $7870 \pm 50$  BP, 8976–8548 cal BP;  $7850 \pm 80$  BP, 8980–8459 cal BP;  $6870 \pm 70$  BP,

7849–7584 cal BP and  $6790 \pm 120$  BP, 7918–7439 cal BP) and Sopra Fienile Rossino in the Cariadeghe haut-plateau (Brescia) at 925 m a.s.l. attributed by a radiocarbon date to the same period of the later occupation of the Laghetti del Crestoso ( $6810 \pm 70$  BP 7795–7519 cal BP: Accorsi et al., 1987). Among cores both typical sub-conical types with one prepared horizontal platform and bladelet scars on one face and prismatic ones with two opposite platforms (bladelets production) are present, associated to one burin-like and one discoidal type at Fienile Rossino. At both sites

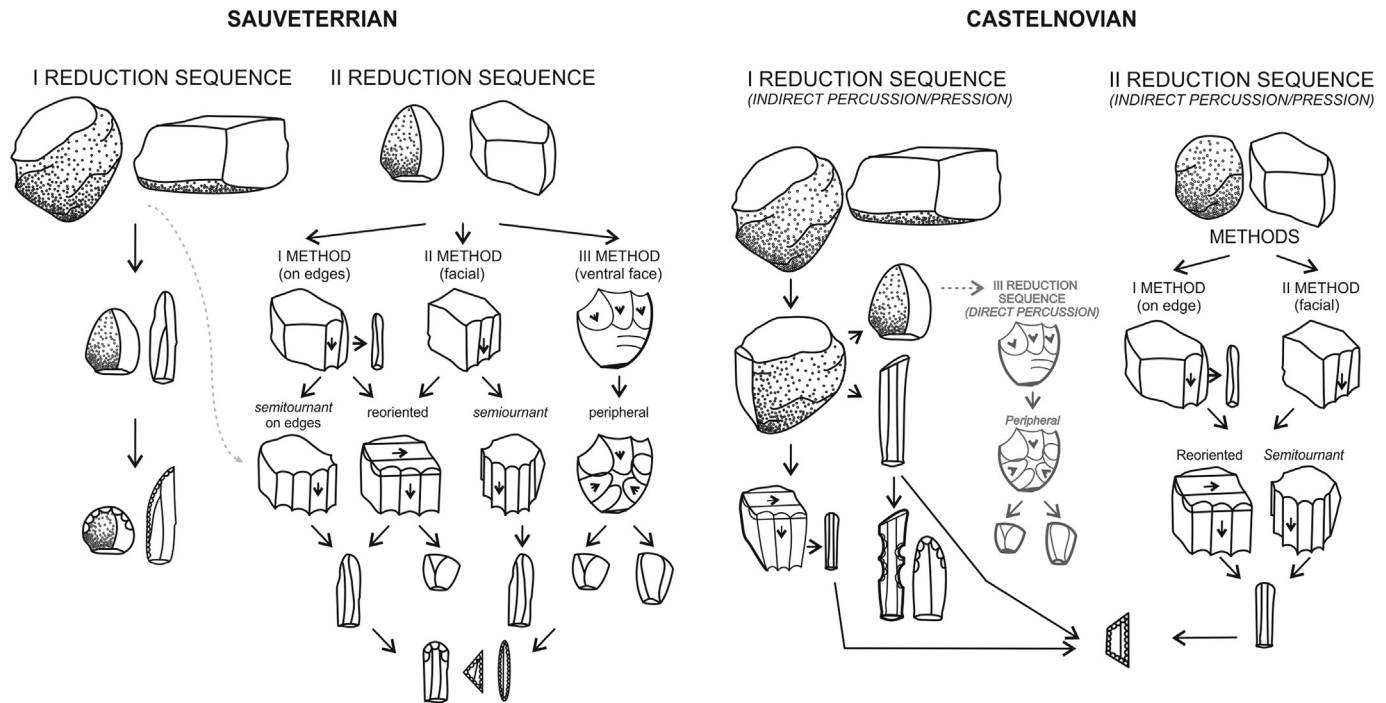


Fig. 12. Comparison between Sauveterrian and Castelnovian reduction sequences in the Mesolithic series of Romagnano Loc III.

trapezes are accompanied by some iper-microlithic Sauveterrian types which are more numerous at Fienile Rossino. At Laghetti del Crestoso authors identify two different occupation phases: the first one characterised by isosceles trapezes with completely retouched truncations, hypermicrolithic scalene triangles, smaller microburins and smaller-sized cores and the more recent one by scalene trapezes with *piquant trièdre* point, larger-sized microburins and subconical bladelet cores. Radiocarbon dates would support this hypothesis with a gap of around 1000 years between the two occupation phases.

In the Venetian Alps two open-air sites are respectively located in the Baldo chain at 1200 m a.s.l. (Fontana de la Teia) and in the Belluno Dolomites at an altitude of 1930 m a.s.l. (Pian della Lora) (Franco, 2003, 2013). The latter site is attributed by a radiocarbon date to  $7290 \pm 50$  BP, 8190–8001 cal BP. Cores are represented by sub-conical types for bladelets with one platform accompanied by some types with double platforms and by oval, sub-conical and globular/polyhedral cores with multiple platforms. Also at these sites trapezes are associated to some Sauveterrian armatures although in different proportions (Franco, 2003, 2013).

In the Tusco-Emilian Apennines, two sites – Monte Bagioletto Alto (Reggio Emilia, layer IV B21 Terre Rosse) and Isola Santa (Garfagnana, Lucca, layer 4a to which an Atlantic age is attributed) have yielded two typical Sauveterrian assemblages (Cremaschi et al., 1984; Koziowski et al., 2003) associated to a very few Late Mesolithic items. The authors interpret these layers as transition levels between the final phases of the Sauveterrian and the early Castelnovian. Franco (2011) records a similar situation at Monte Cornizzolo (Western Lombard Prealps, 1110 m a.s.l.) (Castelletti et al., 1984), Azzurra Cave (excavations 1982 layers 4–1 overlying the Sauveterrian series), Edera Cave (layer 3b, excavations Biagi and Voytek) and other sites of the Trieste Karst (Biagi et al., 2008; Franco, 2011). The presence of some typical Castelnovian items in the Sauveterrian layers of the site of Mondeval de Sora (VF1 – sector I, layer 8 and VF1, sector III, layers 10, 20 and 21) has been interpreted as the evidence of either a short term or a disturbed

Late Mesolithic occupation overlying the early Mesolithic one (Fontana et al., 2009, in press-c).

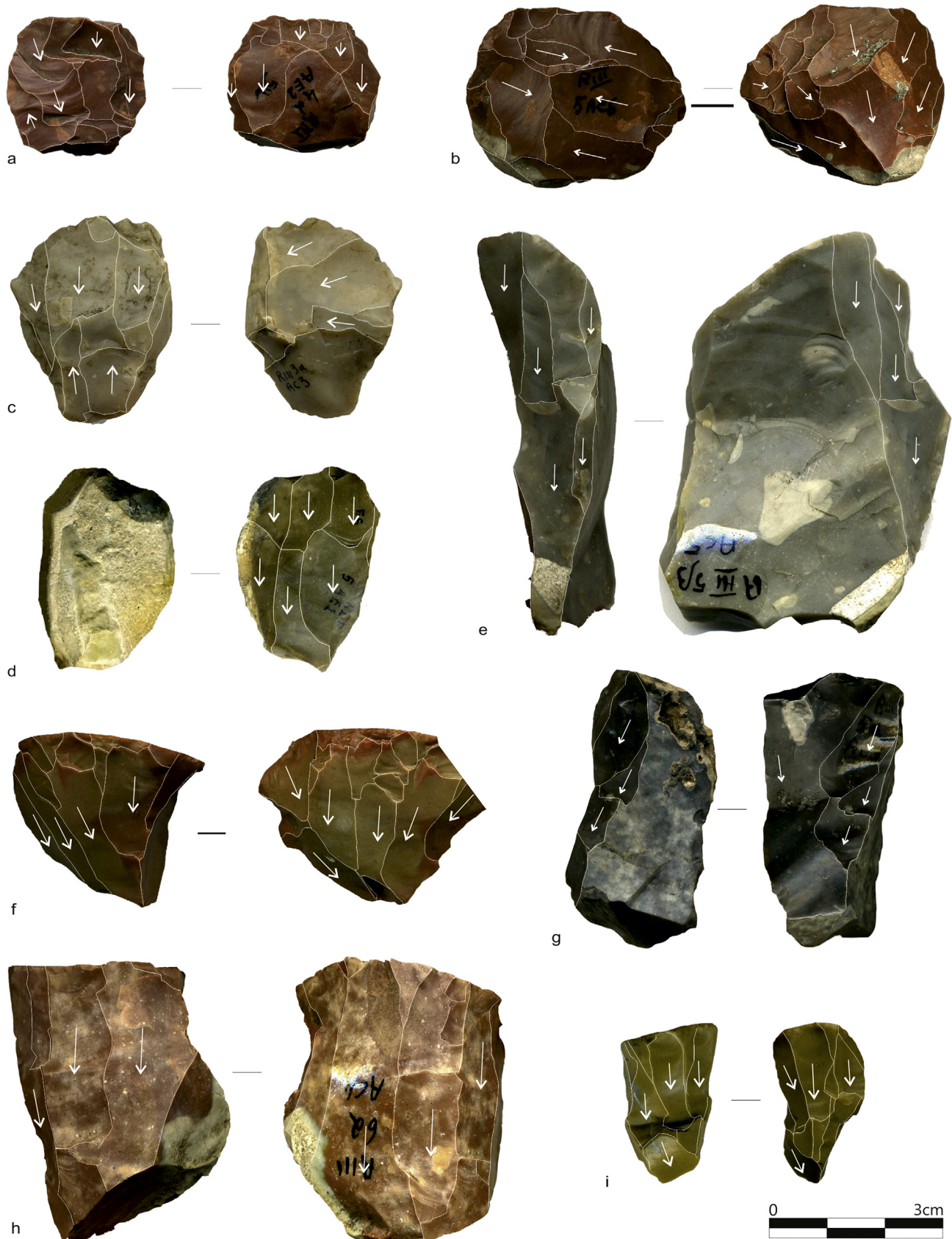
All Italian Castelnovian sites are characterised by elements of continuity, often typological and in some cases even technological, as recorded especially by cores, with the early Mesolithic. In some cases, namely when rock-shelters sites are considered the possibility of disturbance processes are evoked. This aspect seems obvious for Sauveterrian layers that show a few Castelnovian elements (both rock-shelters and open air) while it becomes more difficult to explain when the recent phases of the Castelnovian are involved within deep rock-shelters sequences such as in Romagnano (recent Castelnovian, AA1–2), Gaban and Pradestel. It appears rather questionable that all open air Castelnovian sites are preceded by a Sauveterrian occupation, whereas the opposite never occurs.

## 5. Conclusions

Thanks to the presence of an almost continuous stratigraphical series, this study has allowed to highlight some major changes along with some elements of continuity through time in the Mesolithic assemblages of the site of Romagnano Loc III. Observations have focused on the objectives of *débitage* and the techniques applied as well as on the reduction sequences and methods.

In the Sauveterrian, bladelets and microbladelets have irregular shapes and are obtained by direct percussion, mainly with a soft hammer-stone. Their production is associated with that of small flakes and laminar flakes with no real gap between the different objectives (Flor et al., 2011).

In the Castelnovian, flakes production becomes secondary while bladelets and microbladelets dominate the assemblage and become more regular in their shapes. Namely larger modules (lengths between 25 and 55 mm) are particularly standardized in their width ( $11 \pm 2$  mm). The main technique applied for their production is indirect percussion/pressure although direct percussion continues



**Fig. 13.** Selection of cores from the Sauveterrian sequence of Romagnano Loc III: a, c, d) facial/frontal exploitation; b) peripheral exploitation; e, g) on edge exploitation; f, h, i) semi-tournant exploitation.



**Fig. 14.** Selection of cores from the Castelnovian sequence of Romagnano Loc III: a, c) facial/frontal exploitation; b, d, e) semi-tournant exploitation; f, g, h) on edge exploitation.

to be practiced, especially in the final stages of cores exploitation and for the production of flakes.

Both in the Sauveterrian and Castelnovian, there is evidence for the application of two main reduction sequences respectively aimed at: a) the production of larger and smaller lamellar modules within a continuous scheme by core reorientation and/or platform rejuvenation starting from large-sized nodules; b) the direct extraction of products of small size (lengths under 35 mm) from smaller raw material blanks (sometimes from flakes). In both phases, the latter involves both the production of microbladelets and flakes by the application of separated methods. In the Sauveterrian cores reorientation is frequently documented along with peripheral schemes aimed at the production of flakes while in the Castelnovian unidirectional reduction from a single platform becomes dominant.

The main evidence for changes in the two phases is thus strongly related to the application of the new techniques in the Castelnovian, the use of which seems to influence the final products in terms of shape and regularity. It has also important implications in blanks transformation. Therefore Sauveterrian irregular bladelets/microbladelets and flakes undergo deep transformations both in lengths and widths during the process of microliths production while Castelnovian regular bladelets are either segmented, shortened or remain almost unchanged in their shape.

Some of the characters highlighted in the assemblage of Romagnano are also present in other industries of the Italian peninsula. These common traits (shift from pragmatic to more standardized reduction sequences, increase in the regularity of products, modification in the shapes of final products) allow confirming the occurrence of important technological changes that affect Mesolithic lithic systems during the 9th millennium cal BP. The persistence of some “traditional” aspects has also been observed (expedient production of irregular bladelets in the final stage of reduction of some bladelet cores and of flakes from peripheral cores by direct percussion with a soft hammer-stone). In Romagnano – even excluding layer AB3 – this technical continuity seems to be attested by the most recent layers of the Castelnovian sequence (AB1–2 and AA). It also appears in all other Castelnovian sites, including Latronico and Lama Lite, where hyper-microlithic armatures of the Sauveterrian type are almost absent.

To conclude, if the persistence during the Castelnovian of a pragmatic tradition derived from the Sauveterrian is not difficult to explain when considering the expedient role which laminar flakes and flakes have retained through time, it becomes more challenging to justify the presence of the typical Sauveterrian microliths in these assemblages. Thus, we should evoke either the maintenance of a “tradition” or of a specific function for these items in the symbolic and/or economic system of Late Mesolithic groups. Nonetheless, an economic function does not seem to be validated by the low number of elements that are usually present in these assemblages while when they are documented in larger amounts the idea of a progressive transition seems more difficult to be supported than that of the successive occupation of the same location by different groups. Considering the position of most known sites (valley-bottom rock-shelters and high altitude camps), their role as persistent places occupied over time cannot be excluded *a priori*.

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