The First and Second Mesolithic of La Grande Rivoire (Vercors range, Isère, France): A Diachronic Perspective on Lithic Technology

ANGELIN, Alexandre, PERRIN, Thomas, NICOD, Pierre-Yves
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Alexandre Angelin, Thomas Perrin and Pierre-Yves Nicod

Discovered in 1986, La Grande Rivoire rockshelter is located in the north of the subalpine mountain range of Vercors (northern French Alps) at 580 masl. Five meters of the site’s stratigraphy reveals a continuous chronological sequence spanning the time from the First Mesolithic to the Gallo-Roman period. This paper presents the results of studies of lithic technology of the First and Second Mesolithic sequences (c. 8450–6050 cal BC) in a diachronic perspective. The data gathered contribute to the understanding of the regional chronological evolution. A vertical projection analysis performed in a marginal area of the settlement led us to the identification of eight assemblages. Typo-technological analysis performed on some 12,500 lithic artefacts allowed us to identify three distinctive First Mesolithic and two distinctive Second Mesolithic periods, which is supported by new radiocarbon dates. Therefore, these results permit us to identify, within half a century, the disappearance of microliths on narrow bladelets and the emergence of geometric bitruncations on large bladelets and to update the actual chronological evolution of the regional Mesolithic.

Keywords: First and Second Mesolithic, lithic technology, arrowhead, Alps, mountainous environment

Introduction
Since the late 1970s, French subalpine mountain ranges such as Vercors, Chartreuse, Dévoluy, Bauges, and Bornes-Aravis have been the focus of archaeological exploration. Research undertaken in these regions, and especially in the Vercors range, revealed that this area was repeatedly occupied since the end of the Late Glacial (see Angelin et al. 2016 for a list of references; Bintz et al. 2008). Mesolithic sites were recognized in rockshelters and at open-air locations above 1000 masl, reflecting a dynamic occupation and exploitation of this mountainous environment by Mesolithic people.

Research objectives
To date, the chronological evolution observed for the Mesolithic period (mainly in Vercors and Chartreuse assemblages), remains incomplete (Fig. 67.1) and places the First Mesolithic c. 9200–6700/6500 cal BC and the Second Mesolithic between c. 6700/6500 and 5800 cal BC (Bintz and Pelletier 1999). In order to refine the regional chronological sequence and date high-altitude open-air sites, stratigraphic sequences from rockshelter settlements are taken into consideration. For instance, La Grande Rivoire rockshelter displays a well-developed sequence spanning the time from the First Mesolithic to the Gallo-Roman period and sets itself as a good candidate for our study. Since multidisciplinary and preliminary results have recently been provided for this site (Nicod et al. 2012; Angelin et al. 2016), the aim of this paper is to offer new and complete results on the typo-technological evolution of the lithic industry from the First and Second Mesolithic periods of the site.

La Grande Rivoire rockshelter
The archaeological settlement of La Grande Rivoire is a rockshelter situated in the northern part of the Vercors range, close to the city of Grenoble (Fig. 67.2). The site, located in the Furon Valley, main northern access to the mountain range, faces the south and lies at 580 masl at the foot of a cliff of the Senonian limestone, which contains siliceous flint. It was discovered by chance in 1986 and a rescue excavation was carried out by Régis Picavet from 1986 to 1994 (Picavet 1999). Since 2000 the site has been seasonally excavated under the direction of Pierre-Yves Nicod. The area protected by the overhang is c. 80 square metres wide (Fig. 67.3) and has been carefully excavated by areas and according to the single context recording method by découpes, with excavation units following sedimentary changes and archaeological deposits (Angelin et al. 2016;
Mesolithic layers, compacted in over a meter, are characterized by anthropogenic sediments composed essentially of vegetal organic matter, wood ashes, and heated stones. Archaeological finds are also abundant and mainly consist of faunal remains and knapped lithic artefacts (Angelin et al. 2016; Nicod et al. 2012).

Due to the lack of both features and artefacts in area S19–21 (see Fig. 67.3) as well as some taphonomical processes in area ST21, in this paper, we will only focus our lithic typo-technological analysis of the First and Second Mesolithic layers in area SU16–18 of the site (Fig. 67.3).

Radiocarbon chronology

The Mesolithic chronological sequence of La Grande Rivoire is aided by 14 radiocarbon dates (Picavet 1999; Nicod et al. 2012; Angelin et al. 2016). Six measurements have been obtained from bone samples coming from squares SU16–18 and one from square S19 but are regardless considered in this study (Fig. 67.4, Table 67.1). According to the current chronological sequence (Fig. 67.1), four dates (Lyon-12102 [SacA-41848], Lyon-12103 [SacA-41849], Lyon-12104 [SacA-41850], Lyon-12105 [SacA-41851]) correspond to an early phase of the First Mesolithic, spanning the period from c. 8430 to 7600 cal BC. Two other measurements (Lyon-12106 [SacA-41852], Lyon-12107 [SacA-41853]) correspond to a late phase of the First Mesolithic, spanning the period from c. 7300 to 6600 cal BC. The last two dates (Beta-282248, Beta-255119) correspond to an early phase of the Second Mesolithic, spanning the period from c. 7000 to 6200 cal BC.

Due to the lack of both features and artefacts in area S19–21 (see Fig. 67.3) as well as some taphonomical processes in area ST21, in this paper, we will only focus our lithic typo-technological analysis of the First and Second Mesolithic layers in area SU16–18 of the site (Fig. 67.3).

<table>
<thead>
<tr>
<th>Assemblage</th>
<th>Lab ID</th>
<th>Reference</th>
<th>Excavation unit</th>
<th>Sample</th>
<th>Age BP</th>
<th>cal BC (95% confidence)</th>
<th>Reliability</th>
</tr>
</thead>
<tbody>
<tr>
<td>ASS 5</td>
<td>Beta-255119</td>
<td>GR08.T17.d30.614.</td>
<td>SU16-21.d30</td>
<td>metatarsus, Cervus elaphus</td>
<td>7310±40</td>
<td>6237–6072</td>
<td>Good</td>
</tr>
<tr>
<td>ASS 4</td>
<td>Beta-282248</td>
<td>GR09.S17.d34.</td>
<td>SU16-21.d34</td>
<td>rib, Cervus elaphus</td>
<td>7790±40</td>
<td>6688–6506</td>
<td>Good</td>
</tr>
</tbody>
</table>

Table 67.1. Radiocarbon raw data from Mesolithic levels of La Grande Rivoire (SU16–21) calibrated at 95% confidence against InCal13 (Reimer et al. 2013) using OxCal v4.2.4 (Bronk Ramsey et al. 2013). Reliability is based on radiocarbon dates’ matching with lithic industries.
Beta-255119) are compatible with the Second Mesolithic (6690–6070 cal BC) but need to be refined and confronted with the lithic industry for further discussion. Further analysis and sample collection will soon be performed in order to strengthen the present results and refine the chrono-cultural Mesolithic sequence of La Grande Rivoire.

**Lithic techno-typology: A diachronic perspective**

*Methods*

Prior to the technological study, lithic artefact refitting and spatial distribution analysis have been carried out for excavation units d30 to d48 in area SU16–18 (Fig. 67.3). Data such as the density of unearthed sediment as well as three-dimension provenance of in situ uncovered faunal and lithic remains have allowed us to group excavation units and to identify eight archaeological assemblages numbered in a sequence from bottom to top (0, 1A, 1B, 2, 3A, 3B, 4, and 5).

Raw materials have been grouped by local or regional provenance. Local raw material was collected near La Grande Rivoire and consists of flint nodules present in the limestone cliff. They are of very poor knapping quality. Regional raw material was collected over a wider area (from a few hundred meters up to 50 km) but restricted to the mountain range of Vercors and perhaps Chartreuse (Affolter and Grunwald 1999; Bressy 2003). The latter are of very good knapping quality.

The typological analysis follows the work previously done by Perrin (2001, 2009), allowing us to consider a wide range of criteria, such as blank types and shaping technique.

**Lithic dataset overview**

The eight identified archaeological assemblages are composed of 12,443 lithic artefacts. In each case splinters and thermally affected debris compose most of the assemblage. They exhibit very good evidence of in situ knapping activities and enable different steps of the chaine(s) opératoire(s) to be detailed. However, assemblage 0 (n=26) contains too few lithic artefacts and has not been taken into consideration in this study.

**First Mesolithic**

*Reduction sequences overview*

Through the analysis of cores, blanks, and tools we could identify two main chaine(s) opératoire(s) in assemblages 1A to 3B.

- The first one concerns local raw materials and is directed towards the débitage of flakes by direct percussion with a soft/hard hammerstone. The shaping of the nodules is

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Fig. 67.2. Main alpine mountain ranges of the northern French Alps with principal First and Second Mesolithic settlements. QGIS mapping and CAD by A. Angelin after digital elevation model (DEM) provided and distributed by the NASA Land Processes Distributed Active Archive Center (LP DAAC). 1. La Fru (Saint-Christophe, Savoie, 570 m); 2. Aulp du Seuil (Saint-Bernard-du-Touvet, Isère, 1710 m); 3. Grande Rivoire (Sassenage, Isère, 580 m); 4. Pas de l’Échelle (Rovon, Isère, 980 m); 5. Coins I and II (Lans-en-Vercors, Isère, 1440 m); 6. Coufin I and II (Choranche, Isère, 550 m); 7. Fontaine de Machiret (Villard-de-Lans, Isère, 1265 m); 8. Pas de la Charmate (Châtelus, Isère, 1100 m); 9. Blachette-sud (Sinard, Isère, 830 m); 10. Pré Peyret I and II (Gresse-en-Vercors, Isère, 1610 m); 11. Pas de l’Aiguille (Chichilianne, Isère, 1610 m); 12. Col de Jibou (Treschnu-Creyers, Drôme, 1580 m).
made *in situ* and the main *débitage* is rather pragmatic with no real side preference but with a constant search for ideal convexities. Core exploitation is generally not pushed toward exhaustion with multiple and successive striking platforms and maintenance phases are nonexistent or can only be linked to *débitage* reorientation. No first-line production of flakes has been identified and the products extracted, disregarding their position within the *chaine opératoire*, are often used as tools (simple use of the flakes sharp edges) and rarely retouched. This *chaine opératoire* decreases in importance throughout the sequence in favour of regional raw materials;

- The second reduction sequence concerns regional raw materials and involves the production of irregular short, narrow, and thin bladelets (of about 20 by 7.5 by 1.5 mm) of triangular section by direct percussion with a soft hammerstone. Bladelet butts are mostly punctiform and less frequently plain. The absence of shaping flakes (cortical ones) suggests that this step was carried out elsewhere (probably in a not-yet-excavated area, or directly in the raw material extraction sites). Core management is strictly unipolar, but the opening of a secondary striking platform is often the case, allowing for the correction of longitudinal convexities. When observable, cores are well maintained by removal of ‘tablet’ flakes, plunging flakes, and rare partial crested bladelets for flanks and *carène* maintenance. The production is often pushed to its maximum or stopped when facing flaking accidents. First-line products are transformed into microlithic backed points and second-line artefacts (maintenance flakes and bladelets) are often directly used as tools, sometimes retouched. This *chaine opératoire* and the proportion of regional raw materials increase in importance throughout the sequence.

![Fig. 67.3. Site plan of La Grande Rivoire showing the main areas excavated since 1986. In dark grey are shown the squares where Mesolithic layers have been reached to date (in 2016). Drawing by A. Angelin.](image)

### Assemblages 1A/B

Typology is characterized by domestic tools, rarely retouched (few backed flakes, truncations, and endscrapers), on local raw materials. At the same time, there is a great variability of arrowheads manufactured on bladelets of regional raw materials (Table 67.2). The most represented types are points with an arched back (or crescents, Fig. 67.5:15–16), axial points (unilateral and bilateral, Fig. 67.5:17) and points with a backed edge and oblique

<table>
<thead>
<tr>
<th>Arrowhead types</th>
<th>Codes</th>
<th>ASS 1A/B</th>
<th>ASS 2</th>
<th>ASS 3A</th>
<th>ASS 3B</th>
<th>ASS 4</th>
<th>ASS 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>Axial points with one backed edge</td>
<td>BA11A</td>
<td>12 (11.8%)</td>
<td>7 (13.5%)</td>
<td>–</td>
<td>1 (3.7%)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Points with an arched back (crescents)</td>
<td>BA11B</td>
<td>25 (24.5%)</td>
<td>2 (3.8%)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Axial points with two backed edges</td>
<td>BA11C</td>
<td>13 (12.7%)</td>
<td>11 (21.2%)</td>
<td>2 (10.5%)</td>
<td>1 (3.7%)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Points with a backed edge and an oblique truncation (scalene triangles)</td>
<td>BA12B</td>
<td>20 (19.6%)</td>
<td>22 (42.3%)</td>
<td>9 (47.4%)</td>
<td>10 (37.0%)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Points with two backed edges and an oblique truncation (Montclus triangles)</td>
<td>BA12C</td>
<td>4 (3.9%)</td>
<td>–</td>
<td>1 (5.3%)</td>
<td>4 (14.9%)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Longitudinal edges</td>
<td>BA14</td>
<td>2 (2.0%)</td>
<td>2 (3.8%)</td>
<td>–</td>
<td>1 (3.7%)</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Undetermined fragments</td>
<td>BA15</td>
<td>25 (24.5%)</td>
<td>8 (15.4%)</td>
<td>7 (36.8%)</td>
<td>10 (37.0%)</td>
<td>5 (62.5%)</td>
<td>–</td>
</tr>
<tr>
<td>Axial points obliquely truncated</td>
<td>TR24</td>
<td>1 (1.0%)</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>Asymmetric bitruncations</td>
<td>BG1</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3 (100%)</td>
<td>–</td>
</tr>
<tr>
<td>Symmetric bitruncations</td>
<td>BG2</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>3 (37.5%)</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>102 (100%)</td>
<td>52 (100%)</td>
<td>19 (100%)</td>
<td>27 (100%)</td>
<td>8 (100%)</td>
<td>3 (100%)</td>
<td></td>
</tr>
</tbody>
</table>

**Table 67.2.** Distribution of arrowhead types for each assemblage in area SU16–18. Codes are after Perrin (2009).
truncation (or scalene triangles, Fig. 67.5:18). Few points with two backed edges and oblique truncation (or Montclus triangles), longitudinal edges, and one point obliquely truncated, complete the assemblage. Rare microburins (n=3) found within the assemblage could attest to the sporadic use of this technique. Other tools are mainly represented by irregular side removals, endscrapers, implemented by endscrapers, all of them obtained from maintenance products.

**Assemblage 2**

Typology of arrowheads (Table 67.2) shows that the most represented types are axial points (bilateral, Fig. 67.5:11–12) and points with a backed edge and oblique truncation (or scalene triangles, Fig. 67.5:13). Few longitudinal edges (Fig. 67.5:14) complete an assemblage where points with an arched back (n=2) have almost disappeared. Other regional raw material tools are represented by plenty of irregular side removals and very few retouched items such as backed bladelets/flakes, truncations, endscrapers, and sidescrapers obtained from second-line products.

**Assemblages 3A/B**

From a techno-typological point of view these two assemblages can be grouped together as one and see multiple changes. For instance, flakes débitage as well as multipolar exploitation lose much of their importance compared to the previous ones. Axial points (unilateral and bilateral, Fig. 67.5:7) obtained from regional raw materials tend to disappear from the assemblages (Table 67.2) and are progressively replaced by points with one (Fig. 67.5:8) or two backed edges and oblique truncation (Fig. 67.5:9–10). Other tools take a more important part in these assemblages than in the previous ones.

**Second Mesolithic**

**Reduction sequences overview**

Assemblages 4 and 5 see radical technological and typological rupture with the previous ones. Behavioural changes are reflected in management of raw materials with a clear disinterest for local raw materials, rarely used or retouched. Thus, the main chaîne opératoire concerns regional raw materials geared towards the production of regular and large bladelets of triangular (rhythm 1-2/2-1) and trapezoidal (rhythm 1-2-3/3-2-1 and 2-1-2') section by indirect percussion. Products issued from the first-line production are transformed by bitruncations for the creation of trapezes.

Other retouched artefacts are mostly obtained from maintenance flakes and bladelets.

**Assemblage 4**

The lack of cores does not allow us to identify any management strategies for the débitage. The latter is geared towards the production of regular bladelets with the width spanning from 8 to 11 mm and the thickness of c. 2 mm. Butts are generally plain and less frequently facetted. Microliths from the previous assemblages have disappeared and are replaced by symmetric bitruncations (Table 67.2, Fig. 67.5:3). Irregular side removals, truncations, endscrapers, and sidescrapers are well represented within the assemblage and are obtained from second-line flakes and bladelets.

**Assemblage 5**

Few cores have been identified, mainly on local raw materials despite the lack of retouched products on these materials. Regional ones are strictly unipolar and show débitage of bladelets until exhaustion. Statistical analysis shows bimodality in bladelets production, a first one with large products with an average width of 12–14 mm and the thickness of 2–4 mm; the second one, much smaller with an average width of 9 mm and the thickness of 2 mm. Most butts are facetted, less plain, and few technological criteria tend to the identification of pressure technique. Bladelets are then retouched by bitruncations, this time mostly asymmetric and larger (Table 67.2, Fig. 67.5:4–6). One microburin found within the assemblage could attest to a partial use of this technique. Second-line items are directly used or retouched.

**Synthesis and discussion**

Through the techno-typological and statistical study of the lithic industry, three distinct periods have been differentiated for the First Mesolithic assemblages (1A to 3B):
Fig. 67.5. Microlithic arrowheads sorted by assemblage. 1–3: symmetric bitruncations; 4–6: asymmetric bitruncations; 7, 11–12, 17: axial points with two backed edges; 8, 13, 18: points with a backed edge and an oblique truncation; 9–10: points with two backed edges and an oblique truncation; 14: longitudinal edge; 15–16: points with an arched back. Drawings by R. Picavet; CAD by A. Angelin.
Fig. 67.6. Correspondence analysis (CA) for the First Mesolithic assemblages (1B to 3B) based on the numbers of arrowheads (Table 67.2) and microburins (MB1 type) per assemblages. Codes are after Perrin (2009, 313–24, fig. 209–23).

- An early phase (assemblage 1A/B), mainly characterized by points with an arched back (BA11B type, Fig. 67.6) among other types. This phase corresponds with the first anthropogenic evidence at La Grande Rivoire and three dates place it in the second half of the ninth millennium cal BC, i.e. c. 8450–8200 cal BC. Despite few similarities with the industry from layer C2 of Pas de la Charmate (Bintz 1995a), this assemblage seems to be more recent;
- A middle phase (assemblage 2), mostly represented by axial points (BA11C type, Fig. 67.6). Only one date places this phase between c. 7950 and 7600 cal BC, after a chronological gap of 250 years with the underlying assemblage. This phase is contemporaneous with layer E4 of Pas de l’Échelle (Bintz 1995b);
- A late phase (assemblage 3A/B), where axial points are progressively replaced by points with one (BA12B type, Fig. 67.6) or two backed edges and an oblique truncation (BA12C type, Fig. 67.6). The diagnosis of the latter elements, already present in the early phase, still needs to be clarified at the site of La Baume de Montclus (Escalon de Fonton 1966). This phase starts after a chronological gap of 300 years with the underlying assemblage. One date acquired for each assemblage respectively suggests that we are facing two distinct occupations sharing (for about 700 years) an identical lithic technology between c. 7300–7050 cal BC (assemblage 3A) and c. 6750–6600 cal BC (assemblage 3B). This phase is contemporaneous with layers E3b and c of Pas de l’Échelle (Bintz 1995b).

For the Second Mesolithic assemblages (4 and 5), two distinct periods have been differentiated:
- An early phase (assemblage 4) with symmetric bitruncations (BG2 type). This phase is dated c. 6700–6500 cal BC and is continuous and somehow contemporaneous with the underlying assemblage 3B; it allows us to identify, within half of a century, the disappearance of narrow bladelets industry and the emergence of geometric bitruncations on large bladelets. This phase matches layers E1 and E2 of Pas de l’Échelle (Bintz 1995b);
- A late phase (assemblage 5) with asymmetric bitruncations (BGI type) dated c. 6250–6050 cal BC.

Conclusion

The spatial distribution analysis and techno-typological study carried out on Mesolithic excavation units d30 to d48 of area SU16–18 of La Grande Rivoire allowed us to identify eight archaeological assemblages. For the First Mesolithic (1A to 3B), two main chaines opératoires have been distinguished for each assemblage; one on local raw materials for the production of flakes and the other on regional raw materials for the manufacture of microliths. It has also been possible to refine the chronological sequence of the region, displaying three distinct phases. The early one shows an abundance of points with an arched back and is dated to c. 8450–8200 cal BC; the middle one, mostly represented by axial points spans c. 7950 to 7600 cal BC, and the late one, characterized by points with one or two backed edges and oblique truncation is dated between c. 7300 and 6600 cal BC. From a cultural point of view, these periods have southern affinities and can be associated with the Sauveterrian culture.

For the Second Mesolithic (4 and 5) one main chaine opératoire has been identified on regional raw materials for the manufacture of trapezes by bitruncations of large and regular bladelets. Two periods have been differentiated, an early one dated to c. 6700–6500 cal BC with symmetric bitruncations and a late one dated to c. 6250–6050 cal BC with asymmetric bitruncations. This chrono-typological dichotomy has also been identified in other southern settlements attributed to the Castelnovian culture and most recently at the site of La Baume de Montclus (Perrin and Defranould 2016; Defranould et al. this volume).

Thanks to La Grande Rivoire rockshelter, our understanding of the Mesolithic of the northern French Alps has considerably improved. With this updated chronological evolution proposed for the region now we have a clear sequence that will allow high-altitude open-air sites to be compared. The site shares some similarities with other mountainous sites of the area; our future goal is therefore to enable precise comparisons with other settlements. Also, future investigations of the site along with multidisciplinary studies will help us in advancing a functional and palaeo-ethnological interpretation.
Acknowledgments
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