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GÉRALD BÉREIZIAT

RAW MATERIAL EXPLOITATION STRATEGIES FROM OLDEST DRYAS TO THE END OF BØLLING IN THE SOUTHERN FRENCH JURA: INDICATORS FOR A DIFFERENTIAL BEHAVIOUR?

ABSTRACT: Scene of an intensive occupation at the end of the last glaciation, the Southern Jura has numerous testimonies of the passage of the last hunter-gatherers. For a long time approached under a restrictive vision, this region has been, in the last ten years, the subject of a new research dynamic putting in light the techno-economical behaviour from Oldest Dryas to the end of Bølling. The use of raw materials and the sourcing strategies are very good indicators of behavioural differences. A two-pronged approach combining geological and archaeological data shows that, within a stable set of norms according to the common Magdalenian culture, the evolution of sourcing modalities and the reconstruction of itineraries contribute to discuss the variability of cultural patterns and to put into perspective the supposed homogeneity of populations in the Southern Jura. These different expressions are considered as linked to the specific regional context of a territory sheltered by major rivers and by mountainous areas in the East, where the corridor of Rhône, Saône, and Rhine represents a major communication route in Europe.

KEY WORDS: Southern French Jura – Middle Magdalenian – Upper Magdalenian – Final Magdalenian – Early Azilian – Raw material procurement – Lithic industries

CONTEXT OF THE STUDY

The study area is situated in the southern part of the French Jura Mountains, in the North-East of Rhône-Alpes, a region in contact with Burgundy, Franche-Comté and Savoy but also Switzerland. This region is dominated by the contrast between the plain called La Bresse in the West and a large mountain range in the East

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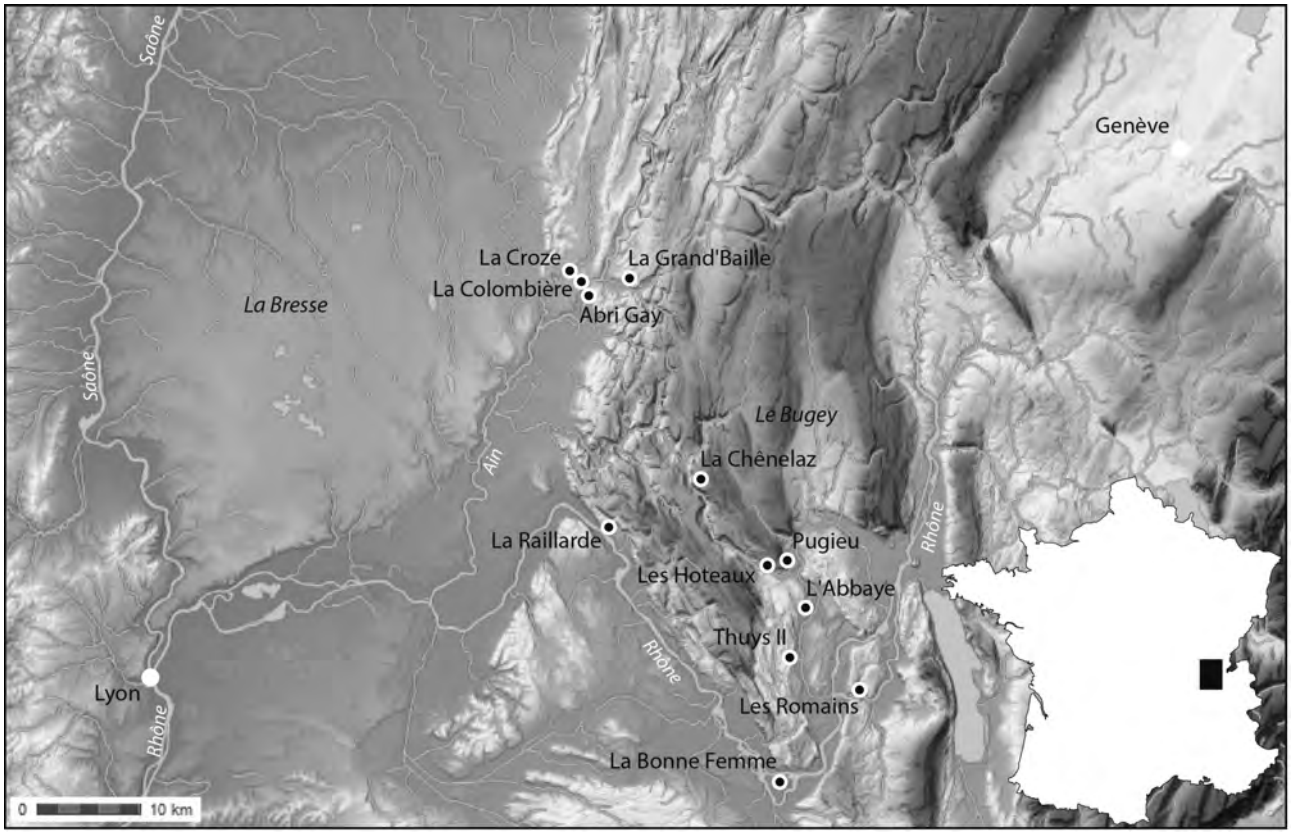

FIGURE 1. Late glacial settlements in the Southern French Jura. Map: copyright Geoportail.

called Le Bugey (*Figure 1*). The twelve archaeological sites of the Late Upper Palaeolithic are exclusively located in the mountainous area, in cave or under shelter, along the rivers, and at heights of 250 to 500 metres. Only the site of La Chênelaz (Hostias) is quite different because it is situated over 900 metres in altitude.

A range of twenty absolute dates allows to discuss and specify the chrono-cultural context for this region (Oberlin, Pion 2009) (*Table 1*). The most ancient ones concern the sites La Croze (Saint-Martin-du-Mont) and La Colombière (Neuville-sur-Ain), both dated within the lower part of the Oldest Dryas. The fact that these two sites are situated in the northern part of the study area (*Figure 1*) is probably an answer to the context of the postglacial lakes which covered almost entirely the southern part of the Jura until around 13,000 BP (Béreiziat 2011). At the end of the Oldest Dryas, during the cold event of Heinrich 1, we register three other dates. The caves Les Romains (Virignin) and Les Hoteaux (Rossillon) are the earliest evidence of the occupation of the South of this region and reflect the colonization of a territory which has remained inhospitable for a long time. Many dates (7) relate to the climate warming of Bølling with its emergence of a temperate fauna like elk or deer. Nevertheless, two dates prove that reindeer is still present until the extreme end of Bølling (La Raillarde – Sault-Brénaz: 12,180 ± 80 BP – Ly 707 / Abri Gay (Poncin): 12,160 ± 60 BP – Ly-640/GrA-9705).

RAW MATERIAL IN THE SOUTHERN JURA MOUNTAINS

All over the Jura Mountains and the northern Alps, the knowledge of the lithic raw material is associated to the framework of several research projects (Affolter 2002, Affolter, Bressy 2009, Bressy 2003, Féblot-Augustins 2002, 2005, 2009, Riche 1998).

The interest of the raw material in the Southern Jura Mountains is recent and follows the surveys carried out between 1995 and 1998 by J. Féblot-Augustins within

TABLE 1. Absolute dates of the French Southern Jura late glacial sites. Dates calibrated following the atmospheric curve intcal 09 (after OxCal 4.1).

Sites	Level	Sample	Lab. ref.	Date	Date (cal BP)
La Croze	Croze II	Charcoal	Ly-434	14,850 ± 350	18,725–17,180
La Colombière	E7-6/27.7	Reindeer	Ly-644/GrA-9713	14,390 ± 70	17,850–17,165
La Croze	Croze II	Ivory	Ly-357	14,370 ± 90	17,859–17,129
La Croze	R7	Reindeer	Ly-638/GrA-9704	14,260 ± 70	17,665–16,997
Abri Gay	81, I-15	Wolverine	Ly-1543	13,795 ± 100	17,150–16,697
La Colombière	D1	Mammoth	Ly-433	13,390 ± 300	17,000–15,164
Les Romains	couche 4	Ivory	Ly-1772	13,140 ± 80	16,535–15,242
Abri Gay	cF2d, G18-123	Reindeer	Ly-639/GrA-9720	12,980 ± 70	16,300–15,110
Les Romains	cIIb, H11-176	Reindeer	Ly-643/GrA-9710	12,830 ± 60	15,864–14,936
Les Hoteaux	?	Reindeer	Ly-1132	12,830 ± 75	15,912–14,913
Les Romains	CIII, H11-206	Reindeer	Ly-642/GrA9709	12,690 ± 60	15,493–14,611
La Chênelaz	c2	Bones (?)	Ly-4790	12,610 ± 200	15,860–14,024
Abri Gay	P13-430	Elk	Ly-1454	12,505 ± 65	15,077–14,197
La Chênelaz	c2	Reindeer	Ly-703/OxA-8027	12,460 ± 65	15,027–14,155
L'Abbaye	Ens.10.12	Deer	GrA-21028	12,390 ± 60	14,948–14,085
L'Abbaye	Ens.10.12	Deer	GrA-20650	12,350 ± 70	14,920–14,028
L'Abbaye	Ens.10.12	Deer	GrA-21023	12,340 ± 60	14,894–14,026
La Raillarde	?	Reindeer	Ly-707	12,180 ± 80	14,512–13,793
Abri Gay	cF2b, 13M-909	Reindeer	Ly-640-GrA-9705	12,160 ± 60	14,190–13,819
Abri Gay	cF2b	Microfauna	Ly-726	11,660 ± 240	14,072–13,083

the collective research project *les premiers paysans haut-rhodaniens*. Based on a study of the geological context (*Figure 2*), this research has identified 73 lithic raw material sources in both primary and secondary position (*Figure 2*), using a combination of petrographic techniques such as macroscopic characterization and microfacies analysis (Féblot-Augustins 2005, Riche, Féblot-Augustins 2002).

The geological history of this region and the different results of tectonic and erosive processes (Féblot-Augustins 2005) show that the available range of materials is important and includes flints proceeding from various stages. For the Middle Jurassic the main rock types are Bajocian and Bathonian. Both flint types present a heterogeneous surface and are often fractured, making them fairly unsuitable for a blade production of quality. However, Bathonian flints can have a finer grain. In the Upper Jurassic period, Kimmeridgian flints can be divided into three groups varying in color and quality. Having in common a chalky cortex, some flints are much fractured, while others have a very homogeneous composition.

In the Lower Cretaceous, we find three flint varieties; Valanginian, Hauterivian, and Urgonian flints are all homogeneous, mat and opaque, with a fine or medium grain. While in Valanginian and Hauterivian the bioclastes are very numerous and visible, Urgonian flints has only few bioclastes. In the Upper Cretaceous, Senonian flints are present as small or medium nodules of irregular form, with a fine and smooth cortex. Mostly fine-grained, these flints are very conducive to a production of small blades or bladelets. The Senonian flints have been largely collected in a secondary position, in sometimes quite punctual areas (sectors Northwest, Northeast, center, *Figure 2*) and mixed with materials from other geological formations. The Senonian flint outcrops in primary position are, until now, only present in the extreme north of the Southern Jura (*Figure 2*).

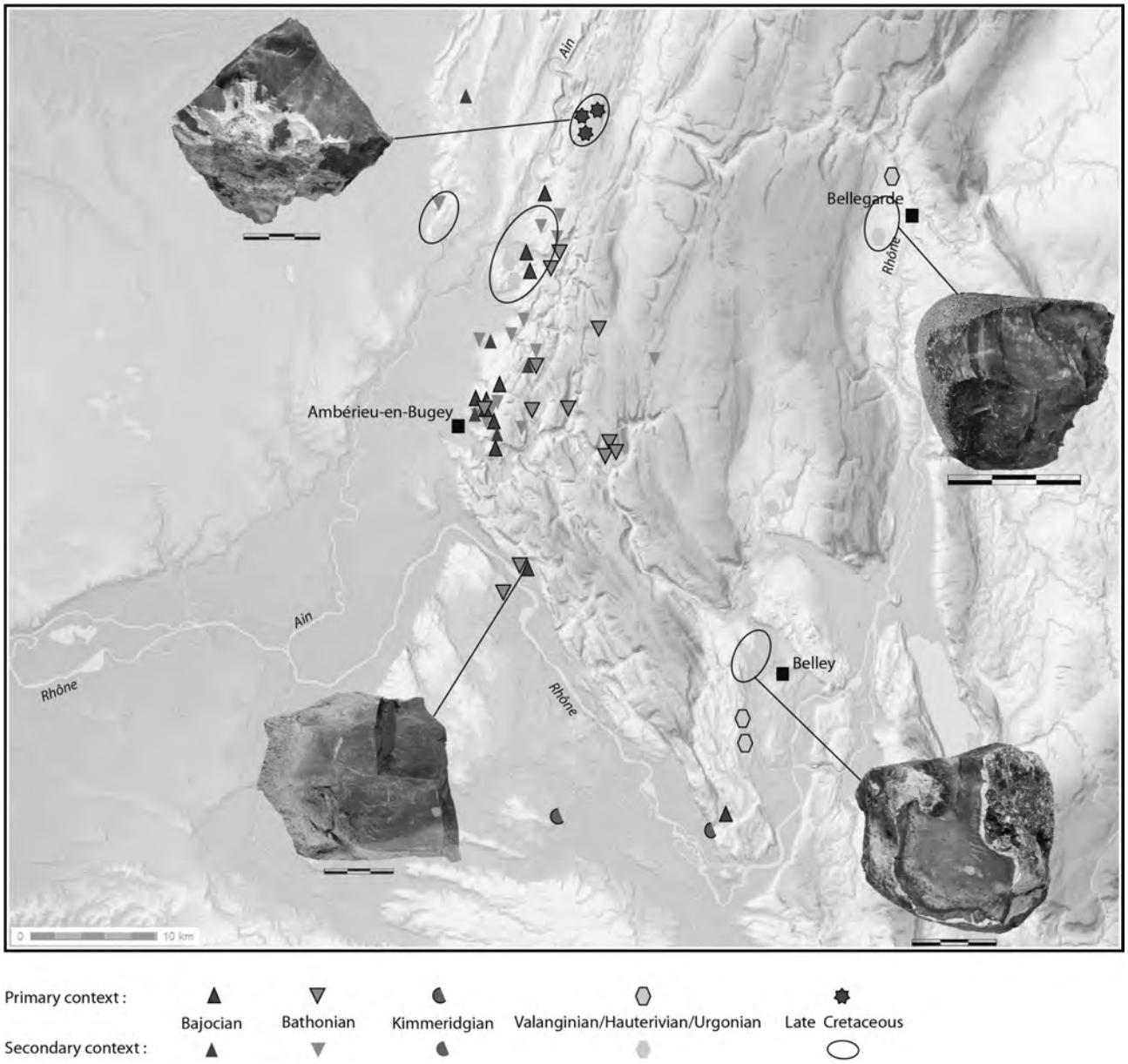

FIGURE 2. Raw material deposit sampled in southern Jura. After Féblot-Augustins (2002, 2005), raw material photos after Féblot--Augustins (2005).

Using this local and also extra-regional knowledge following both macroscopic and microscopic approaches, several sources for raw material procurement have been identified. Preferential axes concerning the circulation of flints can be highlighted, delivering also information on the economical and technological behaviour of the human groups during the Late Glacial period in the Southern Jura.

FROM OLDEST DRYAS TO THE END OF BØLLING: TECHNO-ECONOMICAL APPROACH

Lower Oldest Dryas - Middle Magdalenian

Material remains and absolute dates allocate the occupations of La Croze and La Colombière in the Middle Magdalenian (*Table 1*), but these two sites have

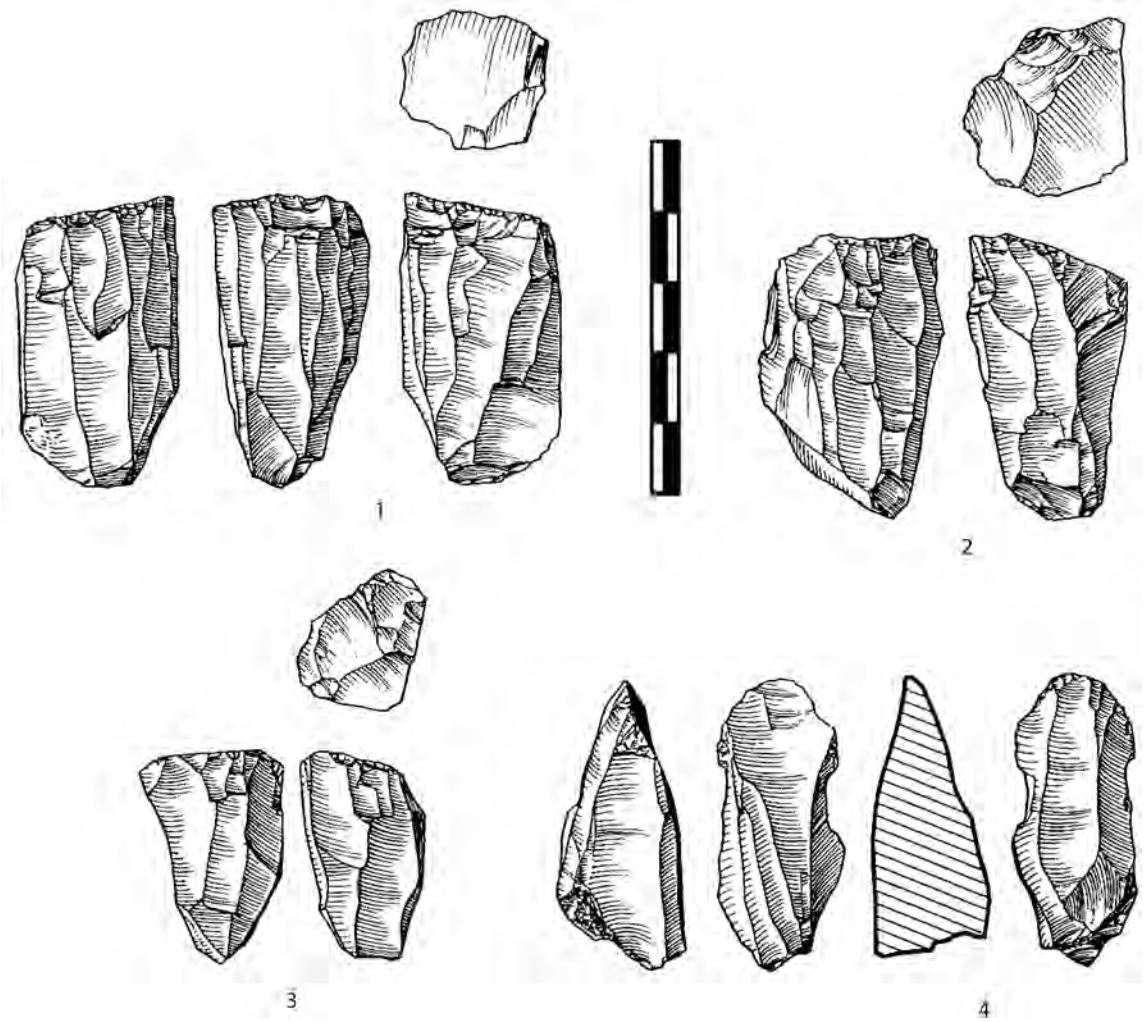

FIGURE 3. Bladelet cores of La Croze. After Desbrosse (1980, Fig. 1).

a fairly original facies. In La Croze, a recent study (Béreiziat 2011) reports that the lithic industry is characterised by a total absence of backed bladelets, while the lithic remains show a significant proportion of bladelets and bladelets cores (*Figure 3*). This situation describes a significant gap with data from other sites of the Southern Jura and other region, where backed bladelets usually represent a large part of the stone tools and an essential factor of cultural identity (Langlais 2007, Valentin 1995). Instead, in La Croze we find a huge number of big drills (26%) (*Figure 4*) and burins (45.7%), arguing a specific function of this site, focussed on working with bone materials and antler. This interpretation is also strengthened by the abundance of bone industry remains (Béreiziat 2008, Desbrosse 1965), and the rich collection of spears (17 pieces) some of which seem to correspond to an unknown type in Eastern France. Instead, similarities can be observed with spears from Kesslerloch in South-West Germany (Mevel *et al.* in press).

The lithic production systems observed at La Croze and La Colombière are inseparable to the procurement strategies. The strong normalisation of the lithic industry shows the omnipresence of the laminar project. For this reason, the raw material is needed in form of large nodules, but the local resources cannot provide with the sufficient nodules. The local flints mainly have the form of irregular nodules of variable but generally relatively reduced size. The raw material must therefore be procured in a broader surrounding. In La Croze, an

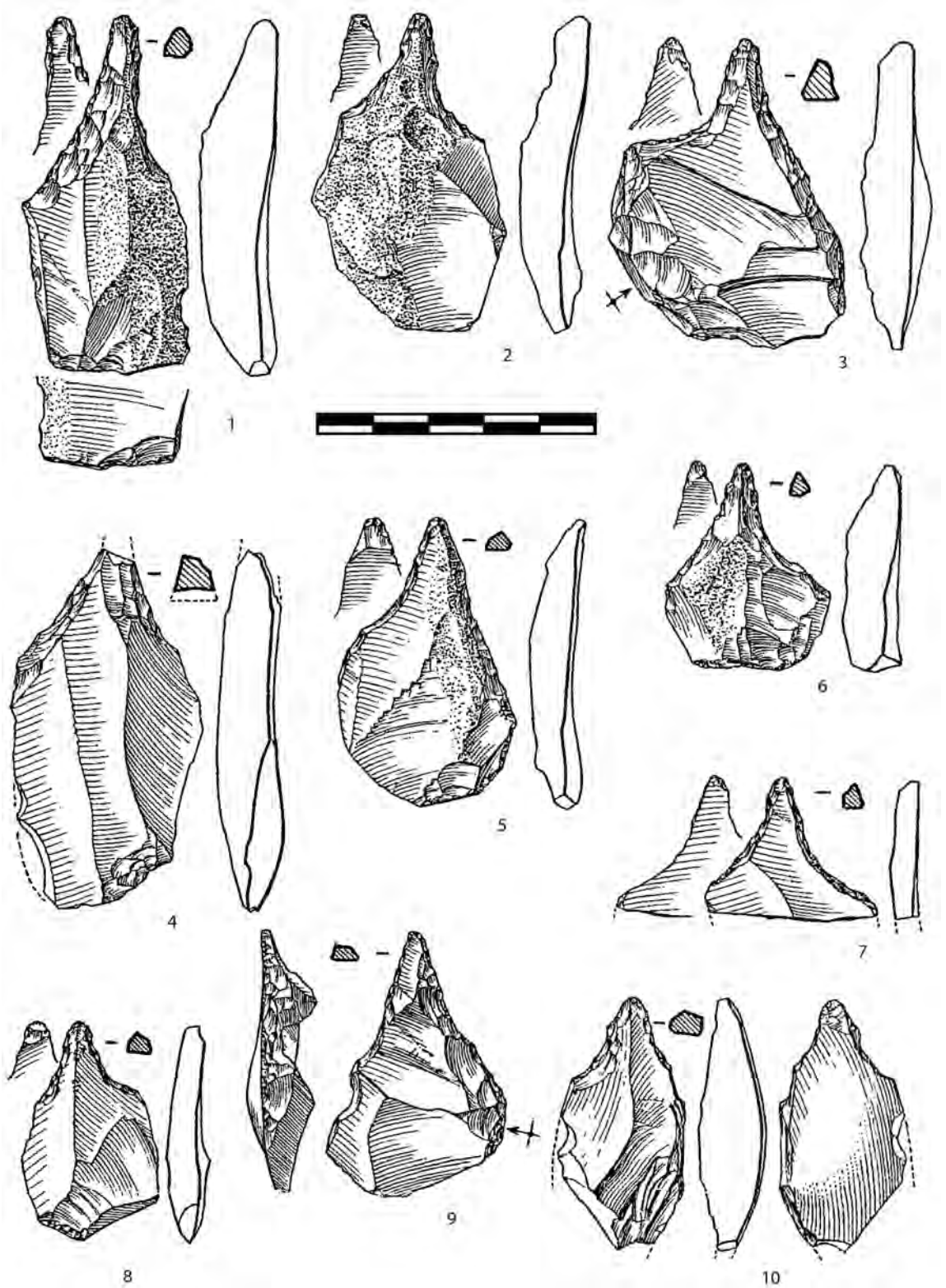

FIGURE 4. Drills of La Croze (Desbrosse 1976, fig. 1).

TABLE 2. Frequency of raw material. Example of the Middle Magdalenian site at La Croze (Saint-Martin-du-Mont).

Raw material	Source	Context	< 5km	< 20 km	> 20km	*N*	%
Localized sources							
Senonian	Leyssard-Solomiat	Primary/secondary		+		668	32.1
Senonian	Poncin	Secondary	+			78	3.8
Turonian	Poncin	Secondary	+			68	3.3
Senonian	Neuville-sur-Ain/ Saint-André	Secondary	+			18	0.9
Hauterivian	Neuville-sur-Ain/ Saint-André	Secondary	+			15	0.7
Undetermined						364	17.5
Potentially sources							
Senonian	Chalon-sur-Saône	Secondary			+	869	41.8
Total						2080	100.0

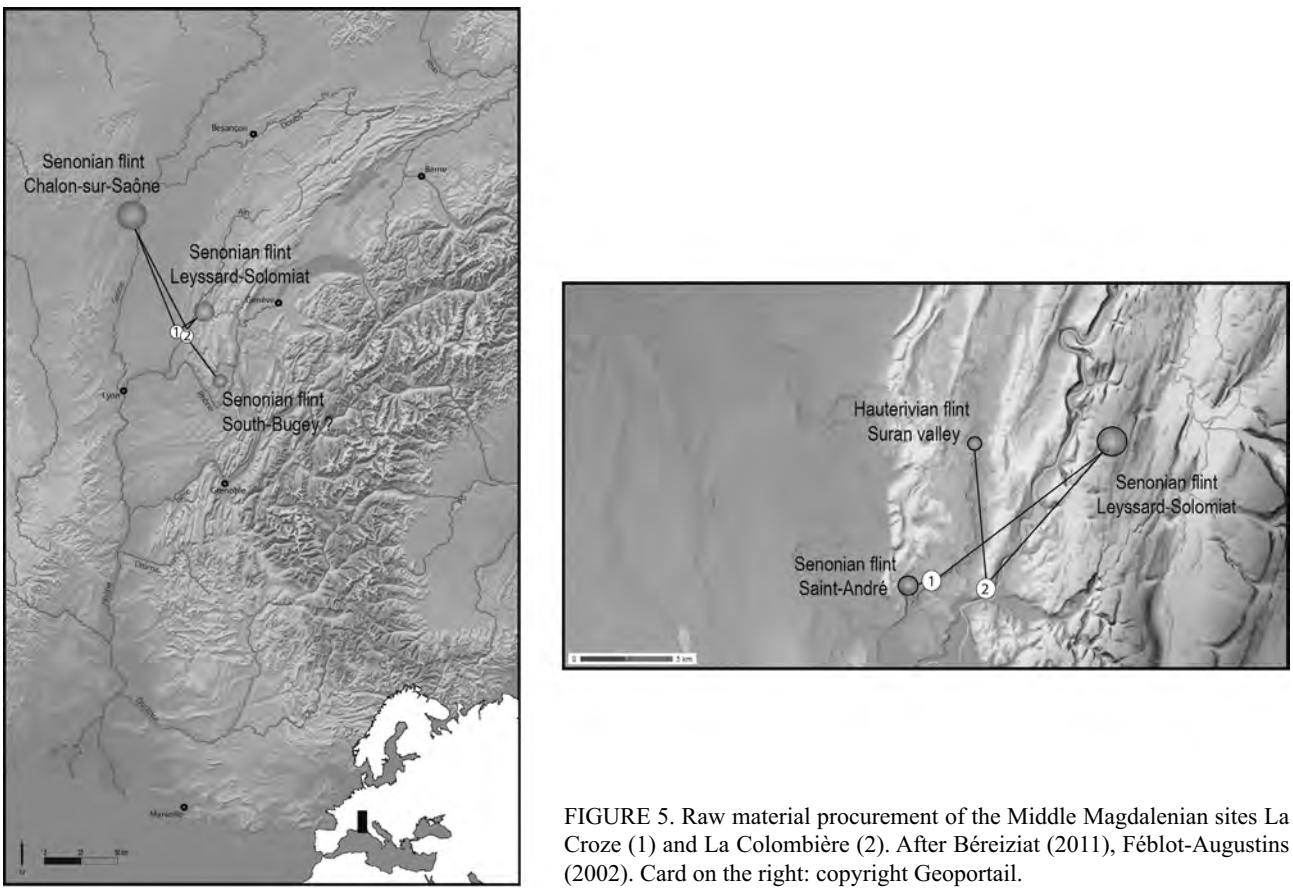

FIGURE 5. Raw material procurement of the Middle Magdalenian sites La Croze (1) and La Colombière (2). After Béreiziat (2011), Féblot-Augustins (2002). Card on the right: copyright Geoportail.

analysis of the raw material (*Table 2*) shows that here we are dealing with quite specific procurement strategies, which are oriented towards allochthonous sources from the Nord-East of the region (*Figure 5*), supposedly at Chalon-sur-Saône, that means from a distance of about 80 km (Béreiziat 2011, Féblot-Augustins 2002). This

material consists of a fine-grained flint with a glossy surface appearance. The structure is homogeneous, sometimes punctuated with small stains corresponding to crystallization defects. The cortex is rolled and worn. In different surveys realized in this region this kind of flints could not be identified in the secondary sources. In contrast, analogies are obvious with flints found in the Chalonian region, but complementary analysis should be realised for verifying this hypothesis.

Another contemporary site at only three km of La Croze,, La Colombière shows a very similar area of raw material procurement, although the Late Cretaceous sources from Leyssard-Solomiat, present in form of large nodules, are preferred (*Figure 5*) (Féblot-Augustins 2002).

This procurement strategy is not unique to these two sites but can also be observed on several contemporary sites of other regions. Close to the concerned area, in Franche-Comté, most raw materials used in the cave Grappin, in Arlay (Cupillard, Welté 2006), come from remote areas (67.3% of the Upper Cretaceous flint located at 17 km in the south and 9.5% of Oligocene flint located at 70 km in the north-west). In Farincourt (Haute-Marne), Cave I and II, and in Rigney (Doubs), most flints come from the Tertiary basin of Mont-les-Etrelles, distant of about 25 to 30 km (David 1996). The importance of allochthonous materials in the Middle Magdalenian sets is also noted on more remote territories as in the Pyrenees, in Troubat, layer 12, and the bottom layer of Enlène (Lacombe 2005).

Within the two sites of the Southern Jura, the links with distant sources cannot be explained by a lack of local raw materials but a deficit in size and quality of the local sources. The sources of Chalon and Leyssard share the particularity of having larger fine-grained nodules facilitating a high quality of both laminar and lamellar production.

From a technological point of view, the senonian flints from Chalon and Leyssard have already arrived in La Croze in a reduced form, and were mostly prepared by shaping an anterior or central-posterior two-sided crest. In some cases, natural convexities were solicited directly by removing a blade or a cortical or semi-cortical laminar flake. Following these two possibilities, we observe the initialisation of the debitage on the longer side, requiring the maintenance of constant convexities (neo-crest blades). The aim of acquiring long blades requires some technical means of production. In this context, the preparation of a striking platform becomes crucial. The cores and lithic remains show a great importance of the process of preparation of contact points, with their characteristic multiple facetted surfaces. More than half of them are marked by slight bilateral over-deep next to the spur. These features are concomitant with the exclusive use of a soft organic hammer. The mainly recognized debitage pattern is semi-rotating and unipolar which gradually invades one of the sides of the cores or occupies the entire nodule. This configuration concerns mainly bladelets cores which have been exploited in laminar continuum (*Figure 3*). Indeed, the different observations and schematic projections do not show any real rupture between the two types of production, except from cases where elements surpass a size of 70 mm (Béreiziat 2011).

Within this very system, the objective of a long blade production also contains some constraints in the selection of raw materials, because this standardisation implies a certain rigidity regarding the treated volumes. It leads to rigidly programmed behaviours which anticipate the procurement strategies. This fact is clearly observed in La Croze, but unfortunately cannot be easily documented in La Colombière, because here the homogeneity of the collections is discussed (Béreiziat 2008, 2011, Combier, Thévenot 1976, Rouch-Zurcher 1991).

End of Oldest Dryas – Upper Magdalenian

At the end of Oldest Dryas, lithic technology from the sites Les Romains, Les Hoteaux, and abri Gay (layer F2d) shows a great variety in the production schemas and an intense production of bladelets (Béreiziat 2011, Haïd, Margerand 1997). In the cave site Les Romains, 78% (more than 1000 pieces) of the lithic industries are backed bladelets (*Figure 6)*, in a few cases willingly fragmented (*Figure 6:1*), and 60% in the Magdalenian level of the abri Gay. The ensembles of backed bladelets from the Southern Jura fit very well into the context of the groups of the Jurassic Arc in the second phase of the regional Upper Magdalenian (between 13,000–12,800 BP). A clearer distinction can be made, however, according to the variations of the relations between simple backed bladelets and truncated elements (Bullinger 2000, Leesch 1993, Le Tensorer 1998, Mevel 2010, Mevel *et al.* in press). The abri Gay and Les Romains integrate a facies of the Jurassic arc with less than 10% of truncated elements.

In Les Romains, the procurement of raw material follows two different modalities concerning the production of bladelets: One, *in continuum*, that is, with continuity between blades and bladelets, and a second one, autonomous or independent.

Thus, the variety of the production schemas answers to an extended territory for the raw material procurement and a greater variety of raw materials itself (*Figure 7*,

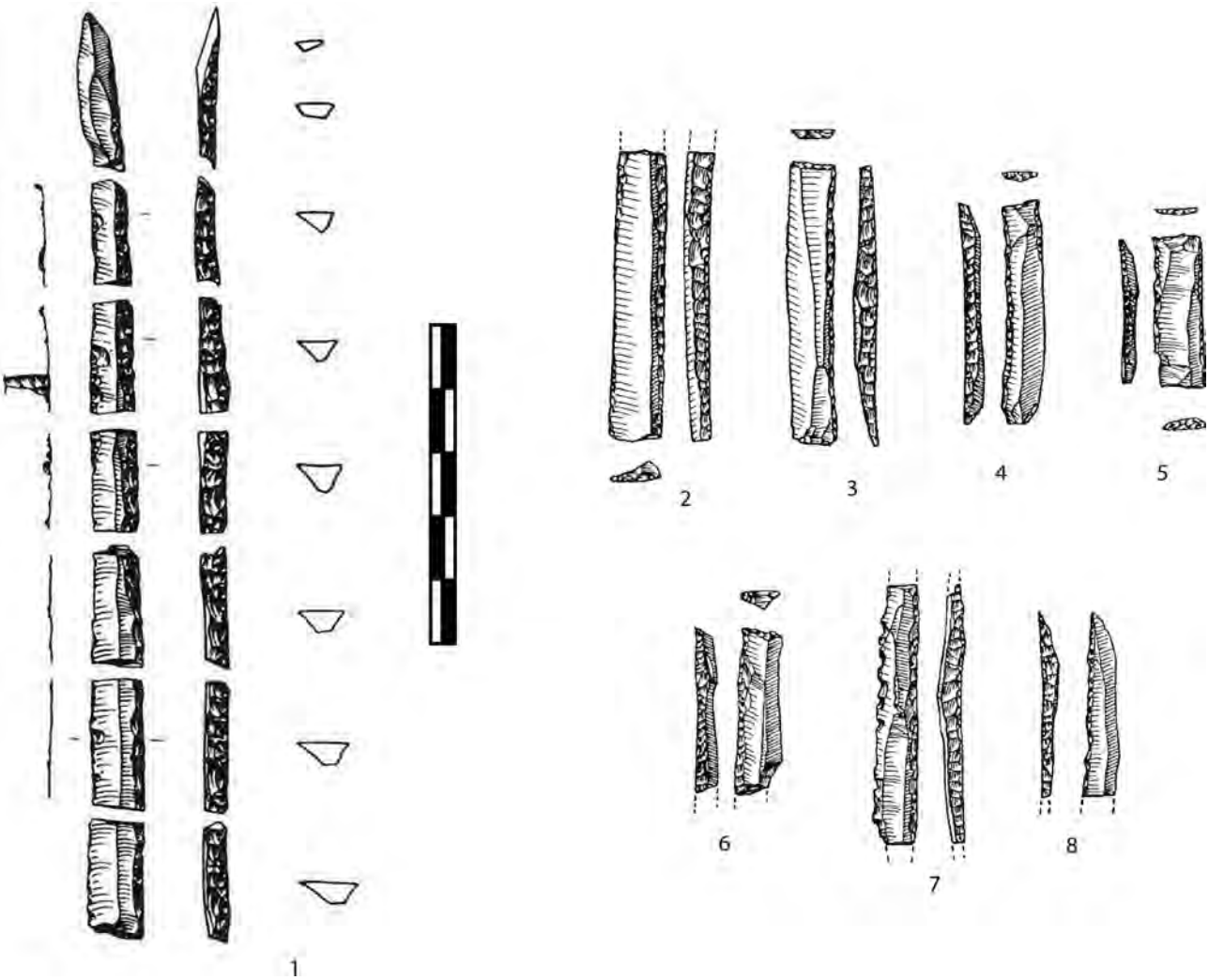

FIGURE 6. Les Romains cave. 1, sectioned backed blade(let)s; 2–6, truncated backed bladelets; 7–8, simple backed bladelets. Modified after Haïd, Margerand (1996: Fig. 5).

Table 3). We find the Barremo-Bedoulian flint from the southern Vercors (5.5%), situated at 100 km from Les Romains, and the Senonian flint from the region of Bellegarde (4.6%), located at 50 km from the site. The Barremo-Bedoulian flint describes several facies which cannot be related with certainty to this area. Indeed, although particularly present on the plateaus of Vassieux and Ambel (South Vercors), outcrops are also found further south, in the area of Diois (Affolter, Bressy 2009). The most common type is a dark gray to black coloured, quite fine-grained flint. Its cortex, sometimes thick and chalky, sometimes smooth and worn, describes two contexts, one primary and one secondary, which refer to decalcification clays.

The Senonian flint from the region of Bellegarde is quite heterogeneous and responds to the diversity of flints in this zone (Féblot-Augustins 2002). These elements describe a flint of high quality, present in the form of rounded pebbles. The occurrence of cortical pieces indicates that the shaping operations took place mainly on the site, although the existence of some previously tested or prepared nodules cannot be excluded.

The most distant point in the North is reached at Mont-les-Etrelles at 200 km. We find some elements from Chalon-sur-Saône and the Northwest of the Southern Jura. These sources are mainly documented by used products.

TABLE 3. Frequency of raw material. Example of the Upper Magdalenian site at Les Romains (Virignin).

Raw material	Source	Context	< 5km	< 20 km	> 20km	*N*	%
Localized sources							
Hauterivian/Valanginian/ Urgonian	South Bugey	Primary/secondary	+			956	23.6
Senonian	Andert	Secondary	+			309	7.6
Barremo-bedoulian	South Vercors – Diois	Secondary			+	225	5.6
Senonian	Bellegarde	Secondary			+	188	4.6
Kimmeridgian	Morestel/Glandieu	Primary/secondary		+		58	1.4
Potentially sources							
Upper Cretaceous	South Bugey	Subprimary/secondary	+			1399	34.6
Rhône Valley		Secondary			+	101	2.5
Senonian	North-West Bugey	Secondary			+	36	0.9
Alluvial deposits Rhône		Secondary		?		34	0.8
Tertiary	Mont-les-Etrelles	Secondary			+	6	0.1
Senonian	Chalon-sur-Saône	Secondary			+	3	0.1
Undetermined						734	18.1
Total						4049	100.0

However, this diversity does not mask the pervasiveness of local raw materials which constitute 80% of the resources available in Les Romains (*Table 3*). They can be divided into two groups, one referring to the Oligocene conglomerates of the region around Andert and different sources scattered on the plateau of Belley, and the other to a source which is supposed to be close to the site (translucent honey flint). This variety, which has largely contributed to the bladelet production, is very homogeneous and characterized by a very fine grain and a translucent matrix. The nodules are usually small, limited to 80 mm. Possible Upper Cretaceous shreds *in situ* (Pierre-Châtel) could perhaps clarify the origin of such material, but this area has never been surveyed so far. The presence of pieces corresponding to each step of the *chaîne opératoire* reinforces the hypothesis of a local origin.

Further north the other Upper Magdalenian site, Abri Gay (layer F2d), shows the same characteristics containing a huge number of backed bladelets. These bladelets follow one single production scheme; an autonomous production, made from small nodules harvested in the closer surrounding (Senonian flints). This production is mainly realised on rectangular single-purpose nodules (*Figure 8*). Their morphology has naturally guided the debitage, on narrow surfaces or on the edge, parting from a simplified shaping. Some angular crests can maintain the transversal convexity, but they are mainly a result of the removal of natural corner elements. The products of this debitage are thin and rectilinear, or thicker, following the evolution of the flanks. This method of production has been observed in a quite reduced area, which could indicate the presence of one single author.

Even if the map of procurement is less diversified in Abri Gay than in Les Romains (*Figure 7*), we still have a presence of allochtonous materials and, at the same time, an importance of local sources. The local sources have widely been used, as far as they represent 64% of all raw materials. Senonian flints from around Neuville-sur-Ain and Poncin have arrived in form of small nodules, oblongs or flattened, while Hauterivian flints from the area of Saint-André were introduced in larger matrices. Intermediate sources of Leyssard-Solomiat correspond to 11.2% of the total and appear in all stages of the debitage, although only one nucleus is present in the series. The sampling point situated in the extreme north of the area could correspond to a significant presence of Senonian flint from Chalon-sur-Saône (42 pieces), while the southern limits of the samples are

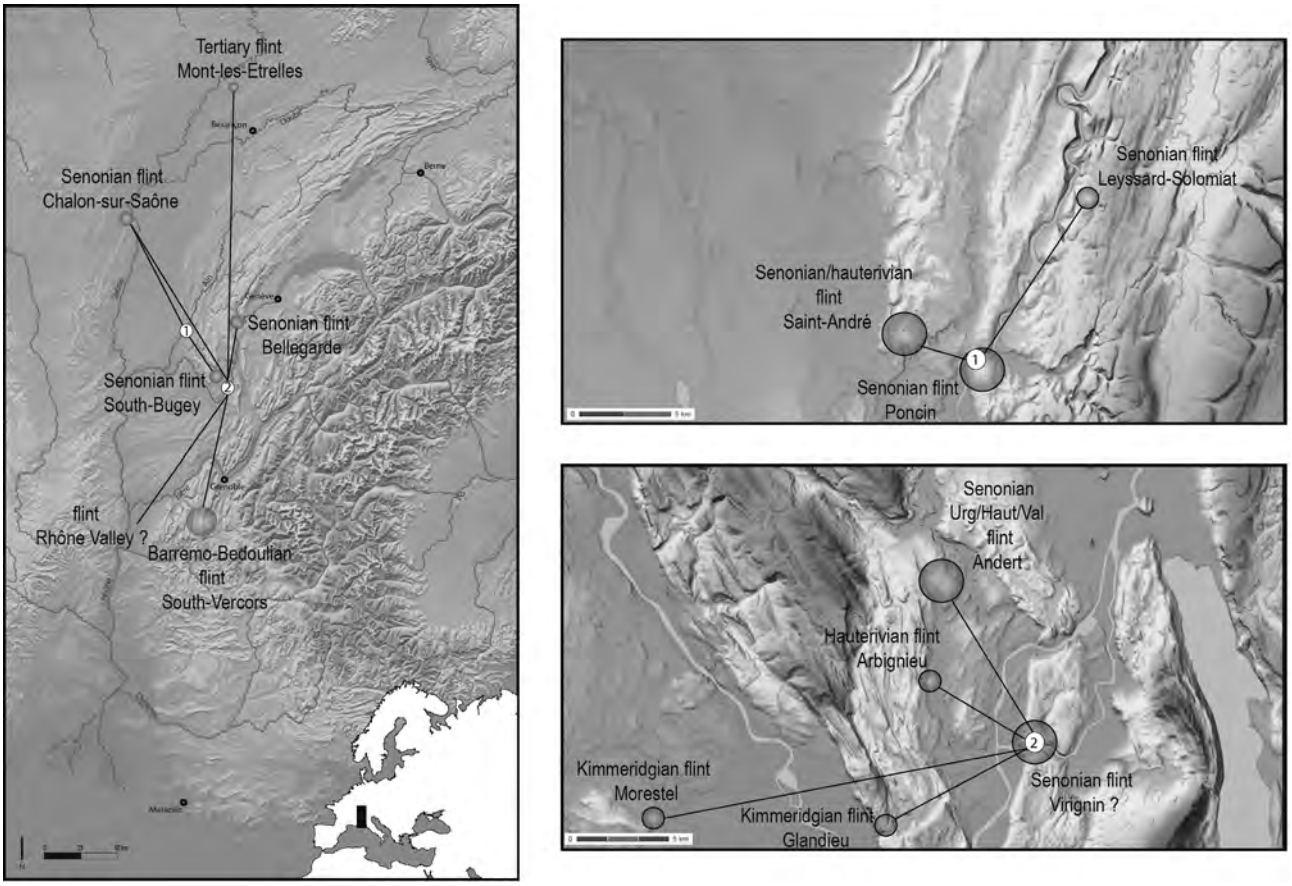

FIGURE 7. Raw material procurement of the Upper Magdalenian sites of abri Gay (1) and Les Romains (2). After Béreiziat (2011). Map on the right: copyright Geoportail.

situated in the southern Bugey (Lower and Upper Cretaceous flints). Like in La Croze, the hypothesis of a Chalonian provenience still needs to be confirmed by the help of more detailed petrographic analysis.

Analysis of the material of Abri Gay and Les Romains show a differential behaviour concerning the importance of local sources than in the sites of the Middle Magdalenian. Here, flints proceeding from the nearer surrounding compose the major part of the raw material, even if procurement from larger distances can still be noticed at the same time. In Les Romains, the economy of raw materials is related to a very large geographical area, with differential procurement strategies. The observed quantities show two privileged areas, Bellegarde and the southern Vercors (*Figure 7*). Raw material import from these remote areas needs a particular investment, similar to the procurement strategies observed for the Middle Magdalenian. However, in terms of techno-economical objectives, the standardisation of products characterizing the Middle Magdalenian does no longer seem to have the same influence on the production scheme.

Bølling – Final Magdalenian and Early Azilian

During the period of Bølling, we notice that the morphotypes of backed points increasingly becomes more variable (angular backed points, shouldered points and tanged points; *Figure 9:4, 7–9*), even if we still find many backed bladelets (*Figure 9:10–11*). These points reflect a great diversity of cultural patterns and, accordingly, a great mobility of the groups and frequent contacts between them. However, the diversity of the morphotypes is not necessarily resulting from a diversity of the procurement areas. The extension of the territory even appears to be reduced (*Figure 10, Table 4*).

At Thuys II (Arbignieu), level C–III (Béreiziat 2011), the map showing the repartition of lithic raw materials indicates a concentration of the procurement in the closer

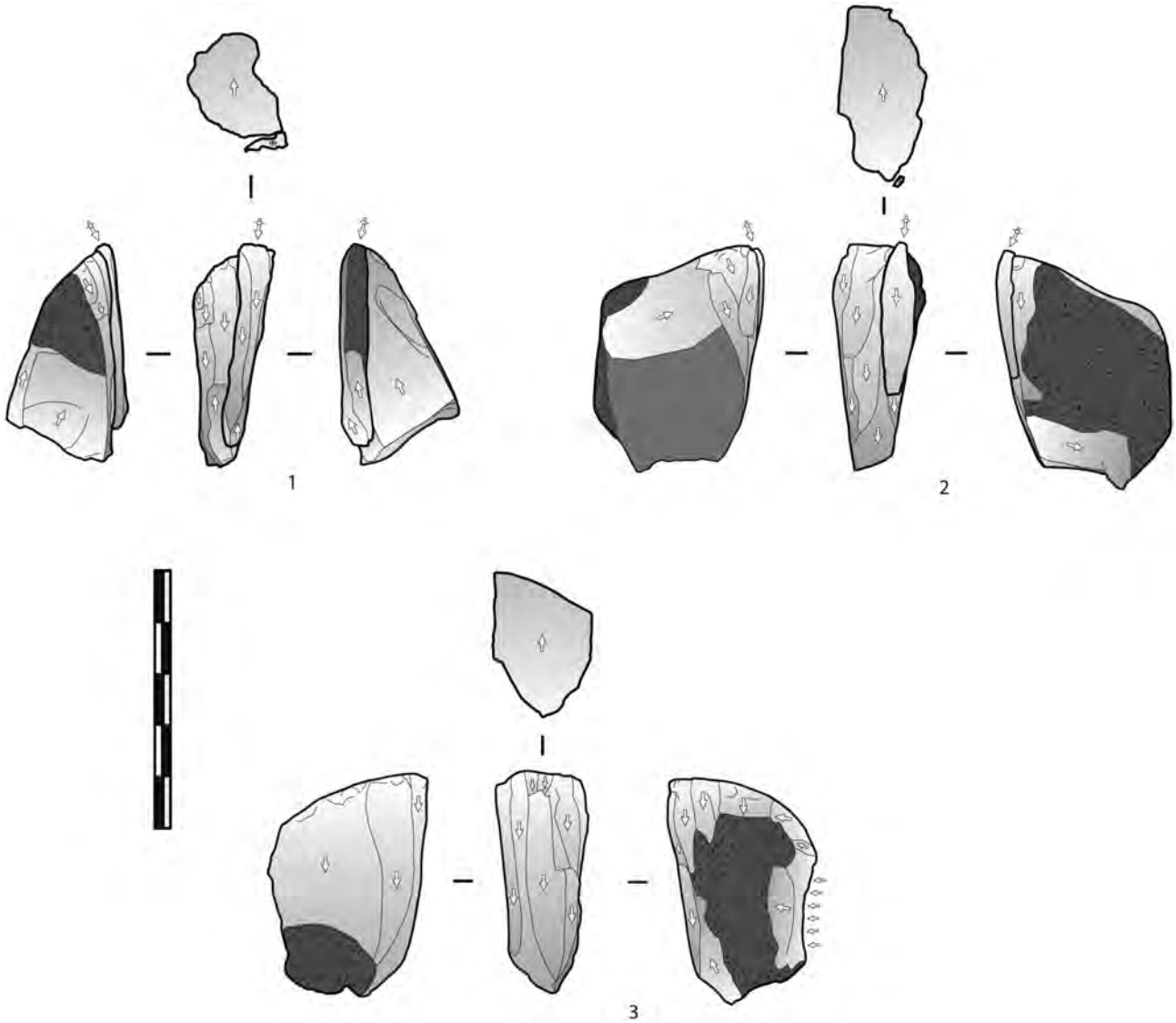

FIGURE 8. Bladelet cores of the level F2d of the abri Gay. 1, Core G18 174 and a refitting of bladelet L20/21 21; 2, Core H19 261 and a refitting of bladelet H19 1097; 3, Core H19 711. CAD by G. Béreiziat.

surroundings (79%), with a dominance of local Lower Cretaceous flints (Hauterivian and Valanginian) and Upper Cretaceous flints (Senonian) (*Table 4*). Another contemporary site, L'Abbaye I (Chazey-Bons), shows the same reduction of the procurement areas (*Figure 10)*. Here, almost 90% of the raw materials are local. The provenience of other minor categories of flint could be supposed in the Chartreuse highland, individualised through similarities with a variety in this sector revealed by petrographic analysis (Féblot-Augustins in Buard *et al.* 2002). However, there does not seem to be any material with origins in the northern part of the Bugey or in the Ain valley. Further north, at La Grand'Baille (Leymiat), a cave site attributed to the Final Magdalenian (Desbrosse 1976), the raw materials show greater differences in quality, with a high importance of local sources (Féblot-Augustins 2002). They represent more than 50% of the lithic material, two thirds corresponding to shaped flints, especially Hauterivian flints, and one third corresponding to the Senonian flints from punctual areas in the neighbourhood of the site. 31% might come from chalk formations at Leyssard-Solomiat, while 15%

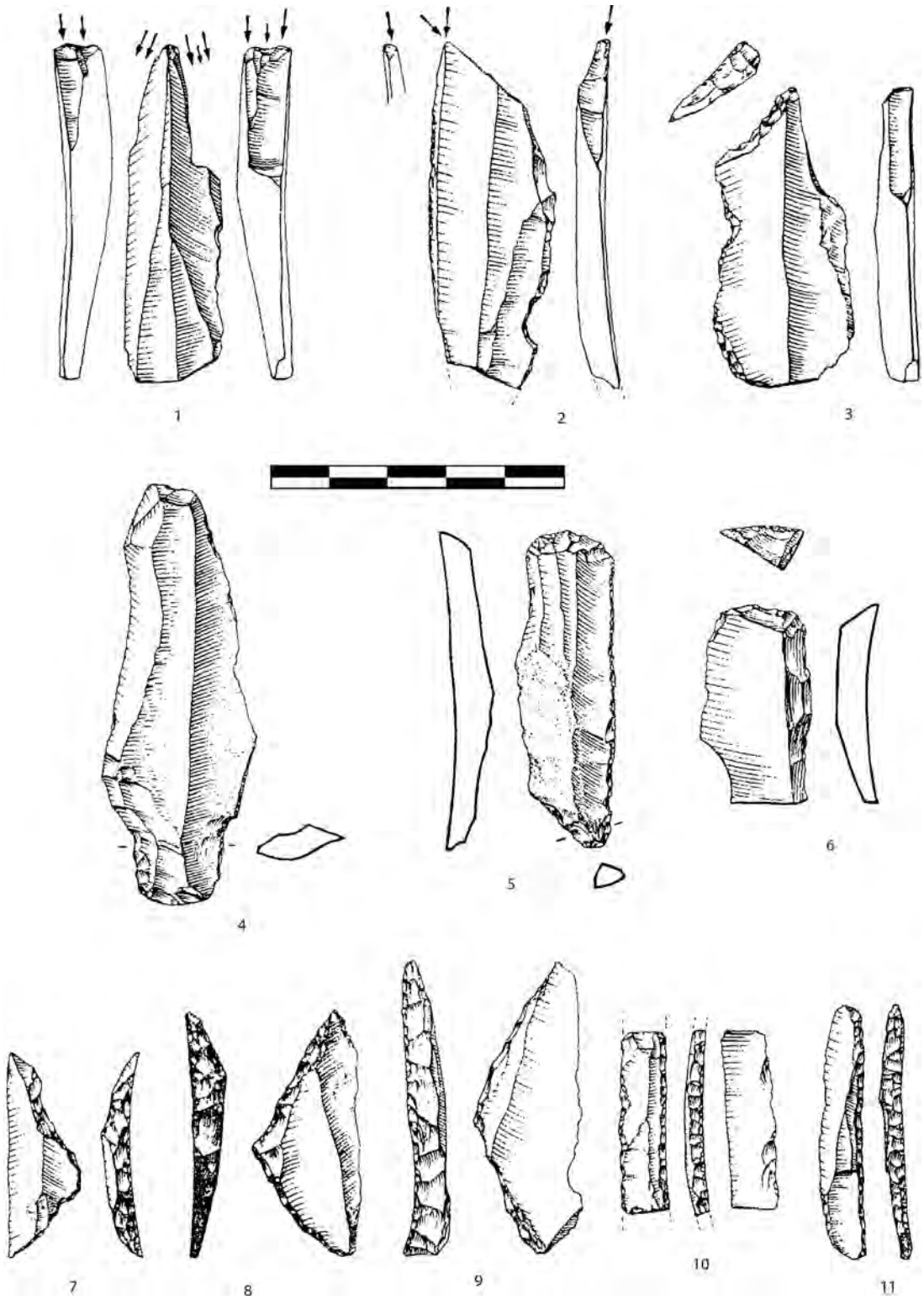

FIGURE 9. Lithic industries of the Final Magdalenian site of La Grand'Baille. 1–2, dihedral burins; 3, truncation burin; 4, point, type Lyngby; 5–7, end scrapers; 7–9, angular backed points; 10–11, backed bladelets. Drawings by P. Laurent.

TABLE 4. Frequency of raw material. Example of the Final Magdalenian site at Thuys II (Arbignieu).

Raw material	Source	Context	< 5km	< 20 km	> 20km	*N*	%
Localized sources							
Hauterivian/Valanginian/ Urgonian	South Bugey	Primary/secondary	+			477	38.9
Senonian	Andert	Secondary	+			277	22.6
Potentially sources							
Upper Cretaceous	South Bugey	Subprimary/secondary	+			215	17.5
Alluvial deposits Rhône		Secondary		?		134	10.9
Lake flints		Secondary			+	97	7.9
Undetermined						27	2.2
Total						1227	100.0

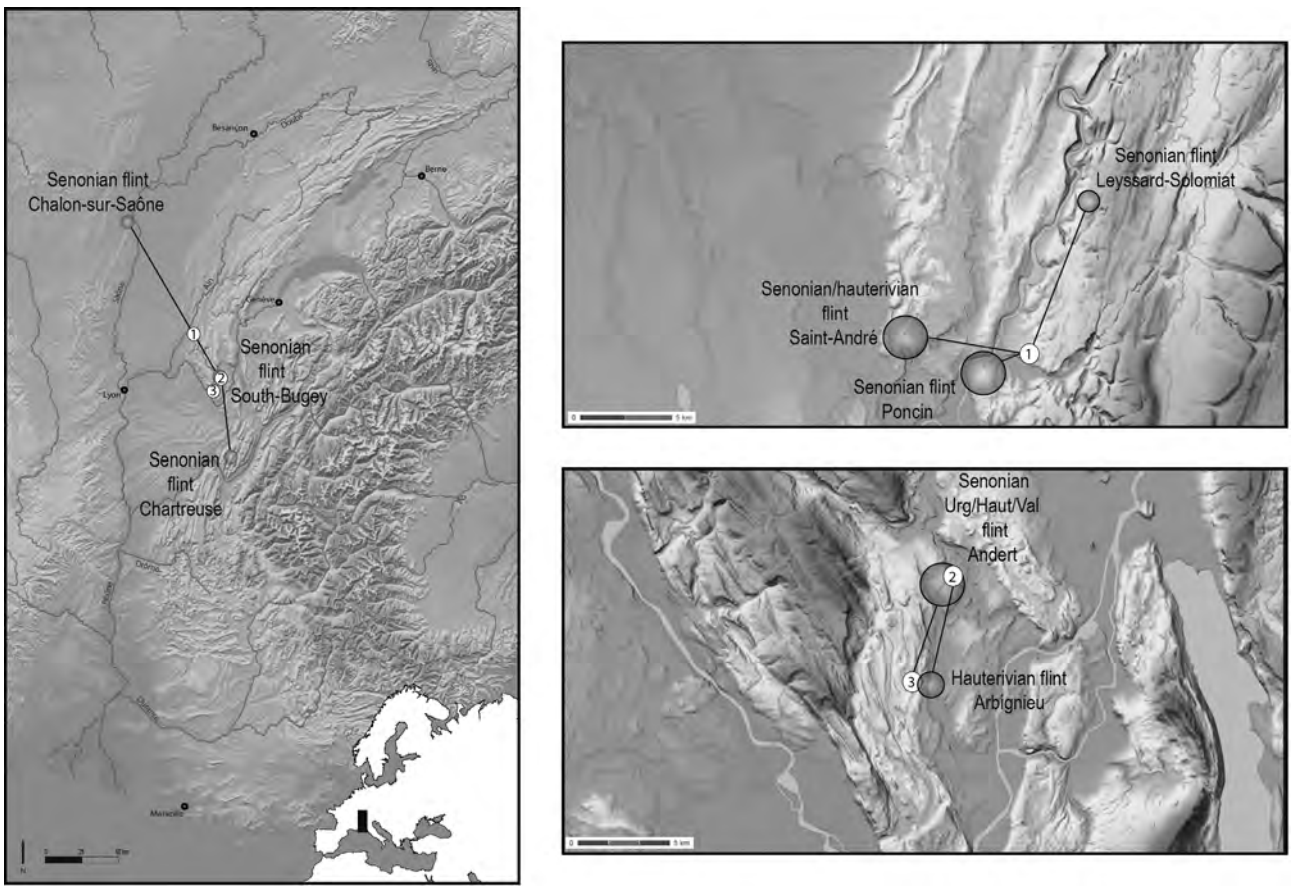

FIGURE 10. Raw material procurement of the Final Magdalenian sites of La Grand'Baille (1), L'Abbaye I (2) and Thuys II (3). After Béreiziat (2011), Féblot-Augustins (2002). Cards on the right: copyright Geoportail.

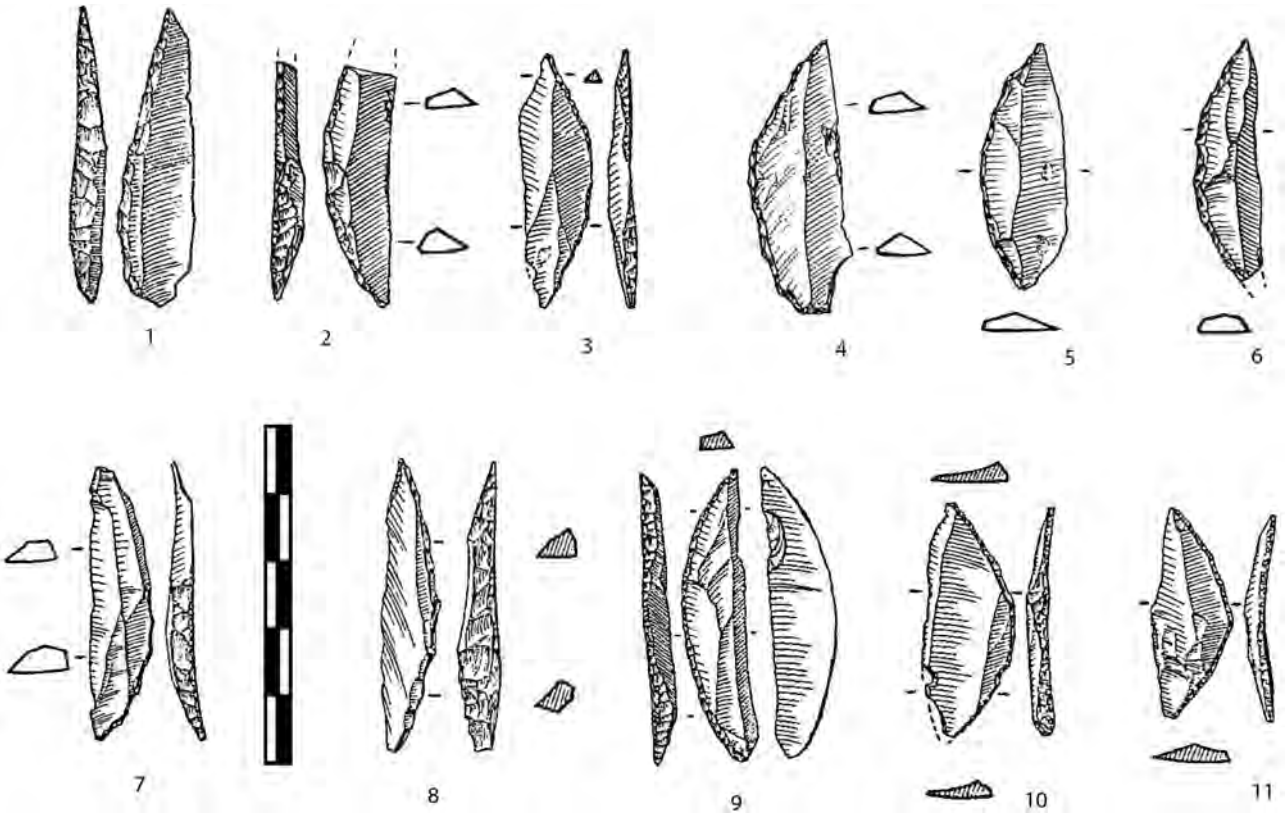

FIGURE 11. Lithic industries of the Late Azilian level F2b of the abri Gay. 1–11, bi-points. Drawings by P. Laurent.

seem to have their origins in the region around Chalon, and a few pieces in the Southern Bugey.

Thus, these sites show a predominant schema of reduction of the procurement territories, even if the presence of allochthonous materials describes a permanence of the contacts or the movement routes already established during anterior periods.

Now, as procurement is centred on local sources, and preformed allochthonous elements are becoming less used, we also notice that the production of blades is becoming more and more flexible.

At Thuys II, the methods of debitage are similar to the general vision of Magdalenian culture where convexity – in the context of the bladelet production – becomes a key factor of the *chaîne opératoire*. Furthermore, the technological characteristics evoke a high importance of traditional behaviour, giving a privileged position to the crest. The elaboration of a dihedral crest is omnipresent, reflecting the will to control beforehand the forms for debitage.

The modalities of debitage noted at L'Abbaye I (Béreiziat in Buard *et al.* 2008) can be inscribed within the tradition of a Magdalenian evaluating towards the Epipalaeolithic. The preparation of the nucleus is often simplified (absence of bilateral crests) and essentially aiming at the production of blades and bladelets. The final products and the care products mostly result from the utilisation of a soft lithic hammer.

At the end of the period of Bølling, the level F2b of the Abri Gay concerns a Late Azilian occupation, with some characteristic mono-points, and an Early Azilian occupation, with many bi-points (*Figure 11*) and a blade production of high quality (*Figure 12*) (Béreiziat 2013). The technical behaviour of the earlier Azilians is still very similar to the Late Magdalenian's, with a production of short blades (*Figure 12*) requiring raw materials of high quality. The mix of Earlier and Later Azilian assemblages does not permit any clear vision concerning the procurement strategies of both occupations, but we still notice that the procurement strategies follow a North-South axis with a high quantity of Senonian flints (20%), supposedly proceeding from Chalon. This is an interesting detail because the allochthonous raw materials were almost absent during the period of the Final Magdalenian.

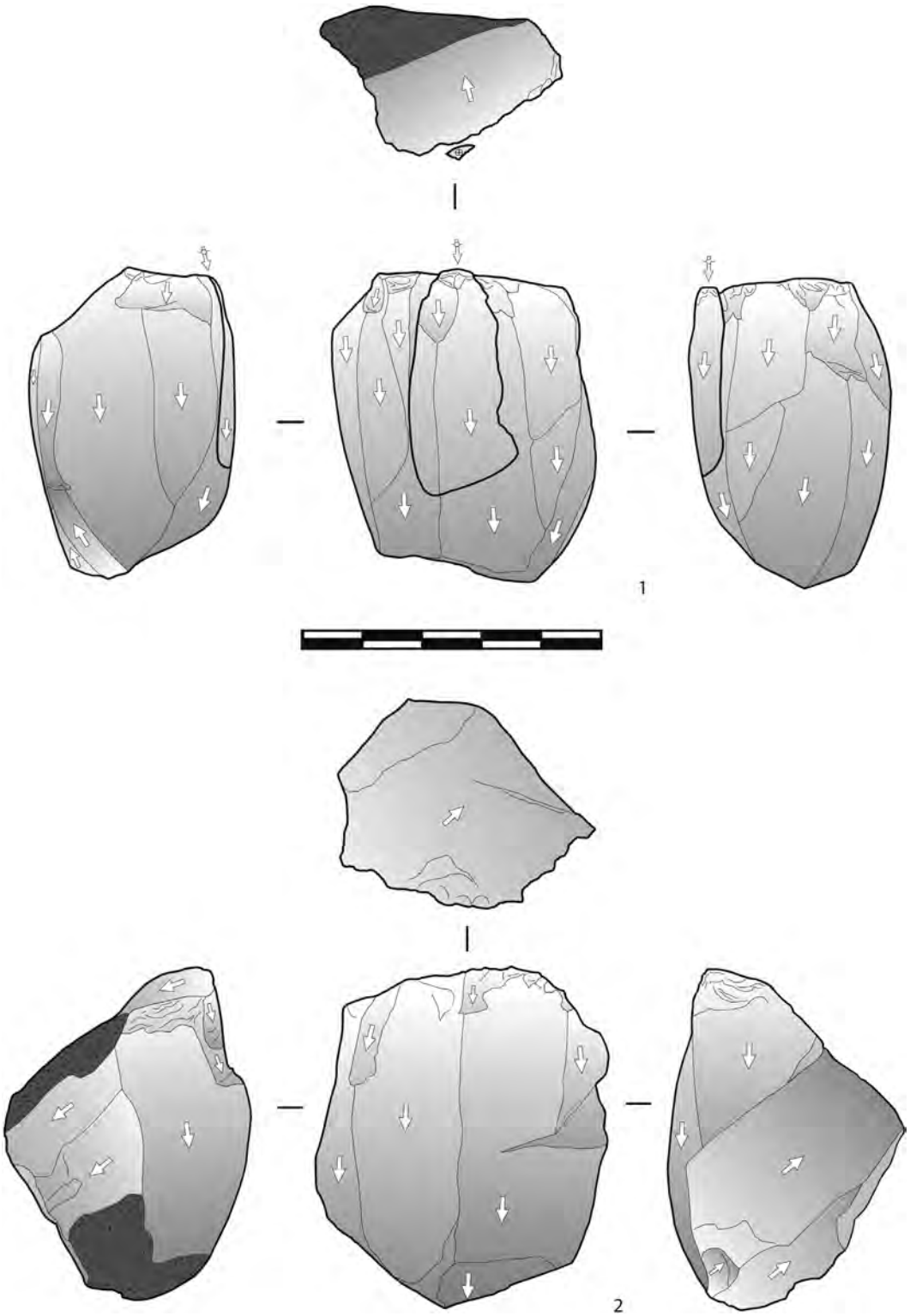

FIGURE 12. Short blades cores of the Late Azilian level F2b of the abri Gay. 1, core K14 62 and a refitting of blade H13 35; 2, core F20 22. CAD by G. Béreiziat.

Present in each phase of the *chaîne opératoire*, this Senonian flint is used for a high quality production of blades, realized by the help of a soft lithic hammer. The blade production seems very similar to the Upper and Final Magdalenian one, what would partially question the commonly accepted rupture with the technical and economical structures of the Magdalenian. These observations have especially led to the hypothesis of an ancient phase of the Azilian, such as observed in the Northern Alps (Mevel 2010, Mevel, Bressy 2009) or in the Parisian Basin (Bodu 2000, Bodu *et al* 2006, Valentin 2008).

CONCLUSIONS

This article allows to put into perspective the behaviours of the last hunters-gatherers in the Southern French Jura. A more detailed vision is drawn of the economy and technology using the raw material evidence. We note that this factor is highly dependent from the limits of cultural identity and technical tradition observed between Oldest Dryas and Bølling. From a diachronic point of view, we observe a change in the procurement areas between the Upper and the Final Magdalenian, and a proportional decrease of materials from distant areas in favour of the local surrounding, even if long distance procurement may persist during the Final Magdalenian (La Grand'Baille) and Early Azilian (Abri Gay, layer F2b). The regular presence of exogenous raw materials in the inventories of the late glacial sites still demonstrates the high mobility of people in an area sheltered by major rivers and by mountainous areas in the East. These procurement strategies consist in importing nodules or preformed products, following a North-South axis. This axis, between Rhône, Saône and further on to the Rhine has indeed played an important role in the migration dynamics of this region. It could even be considered, as noted Floss (2000), as a major communication corridor during the Late Glacial period. This mobility is not only argued by the lithic raw materials but also the ornaments, especially marine shells. For example, in Les Romains many shells come from the Mediterranean (*Homalopoma sanguineum*) (Alvarez Fernández 2001).

The role played by this natural axis was certainly important throughout the Upper Paleolithic and was a major player in the occupation and territorial organization of this space. A better knowledge of raw materials present in each site and a more detailed petrographic and microfacies analysis should allow to strengthen this hypothesis that increasingly appears to be a reality.

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Gérald Béreiziat
Université Bordeaux 1
UMR 5199 – PACEA – IPGQ
Avenue des Facultés
33405 Talence
France
E-mail: gerald_bereiziat@web.de