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# Archaeological Textiles from an Ore-Washing Workshop in the French Alps

## Introduction

This article provides a summary of Master's research conducted at the University of Burgundy (Dijon, France), consisting of the study of more than 400 textile fragments dated from the 12<sup>th</sup> to the 14<sup>th</sup> century, from Brandes-en-Oisans, Isère, France. Stefan Wirth (UMR 6298, ARTeHIS, Dijon) and Christophe Moulhérat (Musée du quai Branly, Paris) were the supervisors. Several questions were raised during the project. The most important of them were to know the function of the textiles found within a specific area (the B102 zone) and whether the textiles from this zone were objects of reuse. The zone was a place dedicated to ore-washing.

## Main context

Brandes-en-Oisans (Fig. 1) was a medieval village located approximately 60 km from Grenoble. It was built at an altitude of 1800 m and divided into several parts: a church, its graveyard, a fortified house, villagers' houses and industrial districts (Fig. 2). Silver and lead mines were located both in and around the village. A steady archaeological presence has been maintained here since 1977, with excavations directed by Marie-Christine Bailly-Maître (UMR 7298, LA3M, University of Aix-Marseilles/CNRS). These allowed for the discovery of more than 80 buildings over an area of five ha. A rich collection of artefacts has been found: pottery, stone and metal objects, glass, animal and human bones and organic material including wood, leather and textiles. These discoveries and their contexts allowed researchers to date the site between the 12<sup>th</sup> and the 14<sup>th</sup> century.

Villagers lived in half-buried stone houses composed of a single room covered by a thatched roof. Domestic pottery, wooden dishes, lighting, cosmetic and clothing elements, as well as games were discovered in the houses. A church was built in the south of the village, on the Rock of Saint Nicolas (*rocher Saint-Nicolas*). In the graveyard next to the building 250 skeletons were found. An equal percentage of children, women and men were discovered. This represents a society based on a familial pattern where the average age was 34



Fig. 1. Localisation of Brandes-en-Oisans (Map: Émeline Retournard).

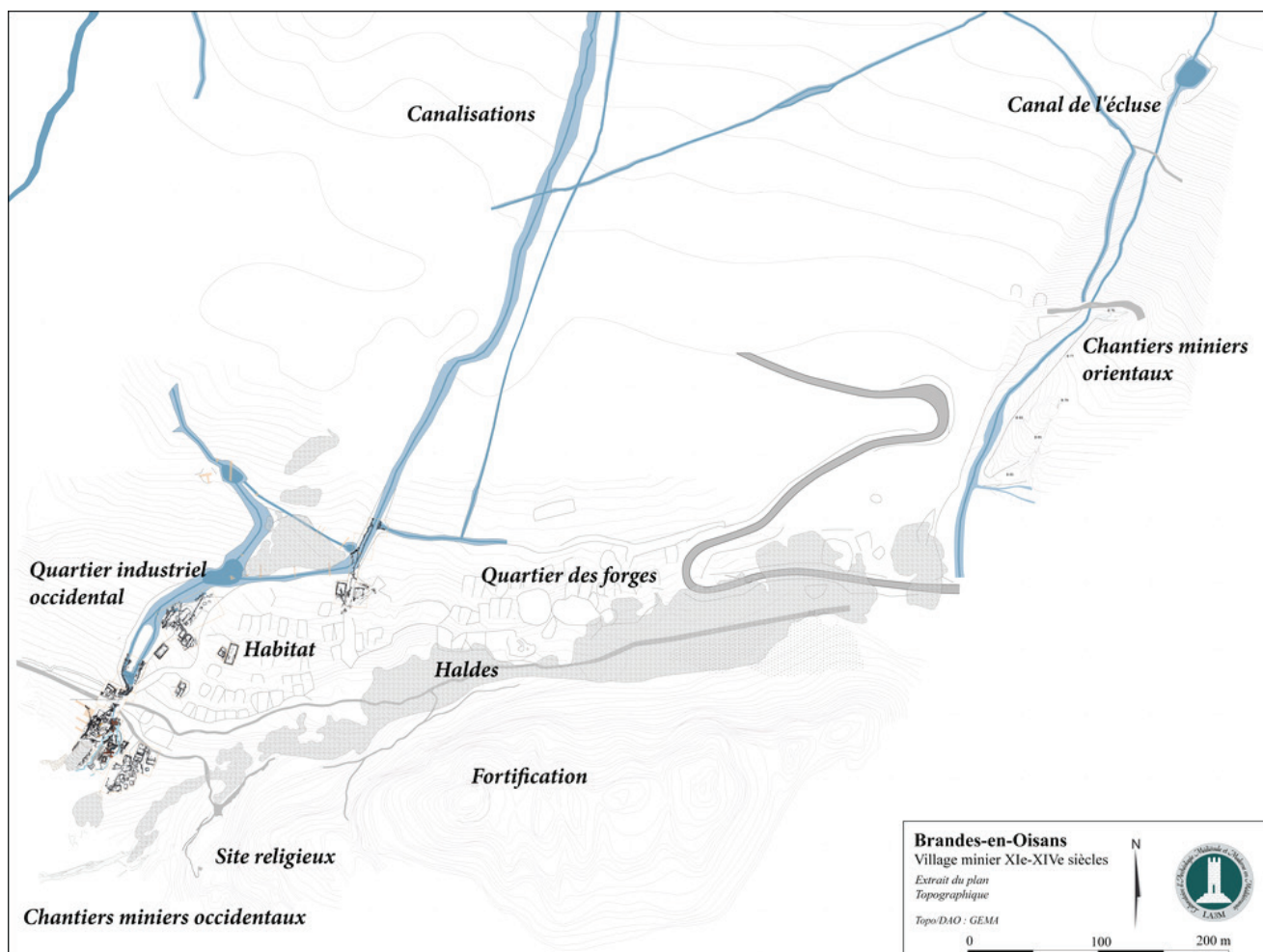


Fig. 2. Plan of Brandes-en-Oisans (up to down, left to right): pipes (*canalisations*), canal of the lock (*canal de l'écluse*), eastern mines (*chantiers miniers orientaux*), western industrial district (*quartier industriel occidental*), forge district (*quartier des forges*), housing (*habitat*), spoil heaps (*haldes*), fortification (*fortification*), religious site (*site religieux*), western mines (*chantiers miniers occidentaux*) (Map: Marie-Christine Bailly-Maître).

years, though some individuals reached 60 years of age. No objects were found within the tombs besides funeral material, such as hairpins, glass and amber pearls, iron belt buckles and scallop shells.

On top of the rock, a fortified circular house was built called a 'shell-keep'. It was composed of a circular wall with a central courtyard and surrounding rooms. A ditch was dug to protect the shell-keep. The function of the building was probably to guard the surroundings. Brandes-en-Oisans is located on a silver and lead vein. At first, miners worked in open-air mines and dug the subsoil with iron tools or fire. Ancient floor levels and ladders were found within at least two galleries. Dendrochronological analysis indicates that the wood used for these elements grew at an altitude between

800 and 1500 m. And it is suggested that local varieties of wood were used for these elements. This also allows us to date the beginning of mining activity between the 11<sup>th</sup> and the 13<sup>th</sup> century.

Mines were first mentioned in a text dated to 1236 AD, while the first mention of the village dates to 1261 AD. 'Brandes' means 'burned earth' in Occitan (a dialect from the south-east of France): it perhaps derives from a mining method where walls were burned with fire to break the stone. At the same time, the medieval name of the village (*L'Argentaria de la Branda* or *L'Argentaria de Brandis*) expresses its main activity: the extraction and treatment of silver ore. Silver was transported to Grenoble as powder for coin mints (Bailly-Maître 2002, 167; Bailly-Maître 2008, 10-56).



Area	Type or location	Number of textiles
B116	Various workshops	583
B102	Ore-washing workshop	445
B21b	Ore-washing workshop	122
B72	House	72
B70	Forges district	30
B54	Ore-crushing workshop	18
B39	Buildings	14
B42	Spring district	12
B71	Forges district	10
B21	Ore-crushing workshop	9
B111	Mining zone	4
B63	Blacksmith's house	3
B3b	House	2
B67	Forges district	2
B34	Ore-washing workshop	2
B12	House	1
B28	House	1
B29	House	1
B105	Pipe	1
B118	Trench	1

**Table 1. Localisation of textiles in Brandes-en-Oisans.**

### Diversity of the corpus

Presently, a total of 1335 textile fragments (fabrics and threads) have been found in 22 of the archaeological areas. Among these areas, two demonstrated a remarkable quantity of discoveries: B116 with 583 fragments and B102 with 445. These were industrial districts dedicated to the treatment of silver and lead ore. Other areas with houses and industrial districts also delivered textiles (Table 1). Some pieces of textiles were restored by Véronique De Buhren (Museum of Textiles, Lyon), as well as by some of her students. One of them, Audrey Éberlé, studied some samples for her Master's degree at the University of Burgundy. The rest of the corpus is neither washed nor restored, and as a result is stored in plastic re-sealable bags. One of the aims of the research was to study textiles discovered in zone B102. A workshop for silver and lead ore washing was discovered in this area. Several

structures of stone buildings along with several washing basins inside and outside of the structure were brought to light. After the technical analysis it was possible to classify some of the discoveries (Table 2). Tabby weaves are divided into three types: balanced, weft-faced and undefined. Twills are represented with 2/1 warp-faced, 2/1 weft-faced, 2/2 warp-faced, unproven 2/2 warp-faced and undefined. Threads are also represented in the corpus in simple and twisted form.

Initially appearing as a uniform mass, the study of the 372 fabrics and 73 threads from zone B102 reveals a diversity of weaves, colours and decoration: Twill is the most common weave in the corpus with 343 samples. 2/2 twill is the most common with 277 fragments. 2/1 twill was also found during the study but in lower quantity: three samples of 2/1 warp-faced twill and two of 2/1 weft-faced twill. Twenty-four textiles are considered as 2/2 twills but the state of conservation does not allow confirmation of this information. Thirty-seven fragments remain undefined, but 35 others are possibly 2/2 twills.

The weaving quality is medium for the 2/1 weft-faced twills and one piece of 2/1 warp-faced twill: the number of threads per centimetre (thread count) is between eight and 12. In the case of the two other 2/1 warp-faced twills, the thread count reveals a finer quality with more than 13 threads per cm. In the case of the 2/2 twills, the quality is more various: four textiles have a thread count lower than seven threads per cm (Fig. 3), 222 are considered as medium quality (8-12 threads per cm: Fig. 4) and 18 are classified as fine textiles through 13 or more threads per cm (Fig. 5). Three samples can be considered as mid-rough and four as mid-fine. Finally, there is no possible thread count for 26 fragments, as they are enveloped in dirt. Two groups of tabby were found in a total of 23 fragments: balanced tabby (with the same number of warp and weft threads) and weft-faced tabby.

Threads are also present in the corpus in bags that have a combination of textiles or alone. In total, 73 threads mostly simple were analysed. Only four twisted threads were discovered. They are composed

Textiles											Fibres			
Fabric									Thread		Animal	Plant		
Plain tabby			2/1 weft-faced	2/1 warp-faced	Twill			2/2 warp-faced?	Unproven	Undefined	Simple		Twisted	
Balanced	Not balanced	Undefined			2/2 warp-faced	2/2 warp-faced?	Unproven				Undefined	S	Z	S(zz)
			Medium (8-12 threads/cm)	Fine (13 and more threads/cm)	Rough (7 and less threads/cm)	Medium (8-12 threads/cm)	Fine (13 and more threads/cm)							

**Table 2. Typology of textiles discovered in a workshop (B102) in Brandes-en-Oisans.**



Fig. 3. Example of rough textile quality: *B102, zone2, D136, n°1* (Photo: Émeline Retournard).



Fig. 4. Example of medium textile quality: *B102, G10, c.78, n°1* (Photo: Émeline Retournard).



Fig. 5. Example of fine textile quality: *B102, +B+12, US68* (Photo: Émeline Retournard).

of two simple threads twisted together. Three samples are twisted in 'S' with two 'z' threads and one sample is built with a 'Z' twist with two 's' threads. One bunch of fibres was identified as human hair (cf. Christophe Moulhérat, Musée du quai Branly, Paris). On the other hand, all the textiles are made of wool. The colours are various: beige, light brown, dark brown, black and several natural colours. Several of these can be present in one piece of textile.

#### Decoration

Sixteen textile fragments in zone B102 contain dyed visible threads. Twelve tabbies and one 2/2 twill (?) were decorated with reddish bands, one beige tabby has a bluish band and two 2/1 weft-faced twill have a bluish background and beige tabby bands (Fig. 6 and Table 3). Concerning the tabby with the red weft-faced bands, the thread counts in the bands are higher in some samples because of a higher beating of the weft. This process allows for a double visual effect with colours and weaving. For the samples from square *B102, +H+19, c. 100*, bands measure five mm high and five mm separate the two bands. A fragment contains at most two bands. The other tabby has a beige background and a blue weft-faced band. Concerning the textiles from square *B102, +F+20, c. 120* and *B102, F6, c. 44*, measurements are more difficult to describe because of the bad state of conservation. A double decorative effect is seen on other dyed fragments (*B102, +C+6, c.44, n°1-2*). These textiles have a main weave in 2/1 weft-faced twill and two tabby bands are inserted on the weft (Fig. 7). Twill is dyed in blue while the tabby is beige. One of the fragments has a weaving mistake, probably because of the incompatibility of the weaves. At the transition between the background and the decoration, the weaver lifted the second thread of the 2/1 weft-faced twill and not the third (Fig. 8). This

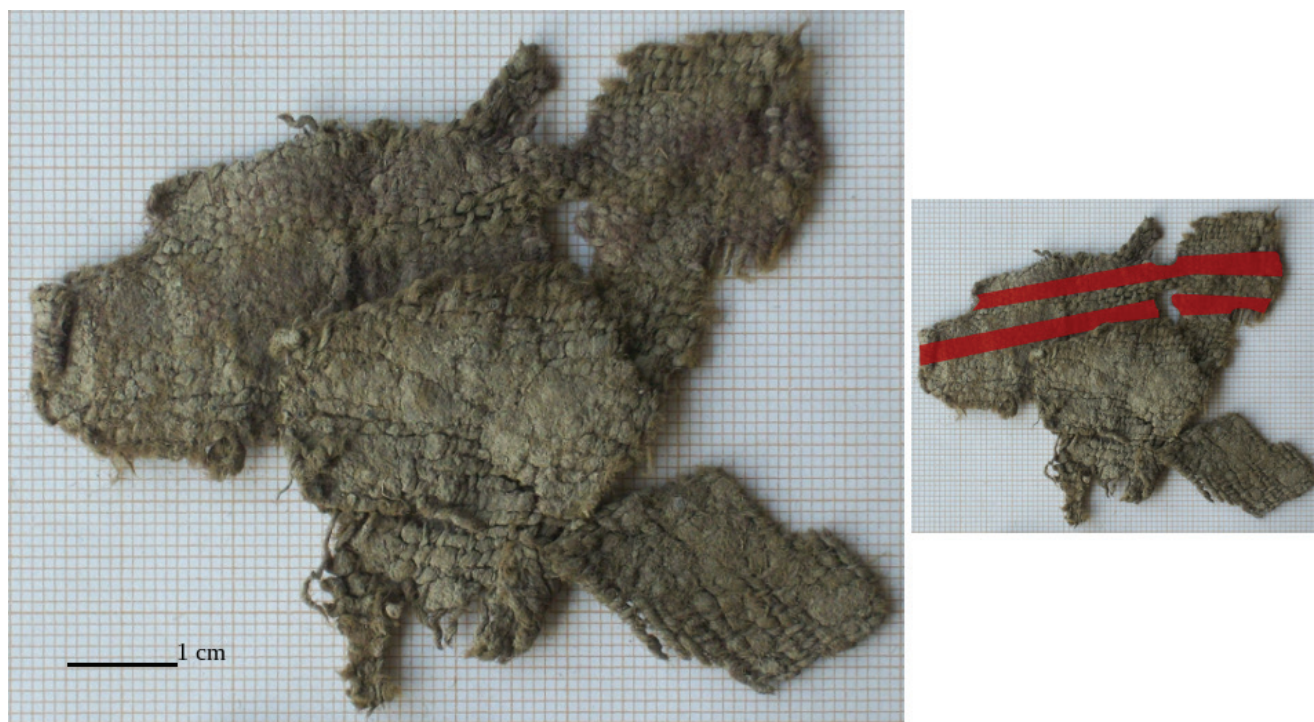


Fig. 6. Example of a decorated textile with reddish bands: *B102, +H+19, c.100, n°1* (Photo: Émeline Retournard).

inattention contributed to a wrong beginning for the tabby. The weaver continued to weave and inserted more weft threads into the second band of decoration to correct his mistake. The bands measure between four and five mm and are separated by two mm. This pattern is reproduced approximately every five cm. Among the 445 textiles, only seven selvages were identified on 2/2 twills (Table 4). All the selvages can be considered as basic (Fig. 9, A). Any preparation of the warp was seen. One of them differs, however: the sample. Even if the construction stayed simple, two threads were taken in the return of the weft during a new passage, instead of one for the other selvages (Fig. 9, B).

Traces of sewing and/or embroidery were discovered on 17 textiles (Table 5). Holes are lined up vertically and/or horizontally. Warp and weft threads are open, not ripped. Holes are empty or full of a sewing/embroidery thread. The size of the related textiles varies. Bigger samples present more holes than the smaller ones (possible previous placement for embroidery: Fig. 10). Unfortunately, it is quite impossible to see a clear drawing in the layout of the holes, as a hole could be used several times. One fragment of 2/2 twill is remarkable in its selvedge embroidery (Fig. 11). Two threads pass into holes every side of the textile in overcast seam. The z-twisted threads are slightly

lighter than the brown wool and have a diameter of one mm.

Cutting marks were also discovered during the technical analysis: several textiles have one or many straight sides. Finally, some textiles present a twisted form: they are s- or z-twisted on themselves. The biggest twisted fragment is 30 cm long.

Textile ID	Main weave	Weft-faced Bands
B102, +F+20, c. 120, no. 1	Beige tabby	Reddish tabby
B102, +F+20, c. 120, no. 2	Beige tabby	Reddish tabby
B102, +F+20, c. 120, no. 3	Beige tabby	Reddish tabby
B102, +F+20, c. 120, no. 4	Beige tabby	Reddish tabby
B102, +F+20, c. 120, no. 5	Beige tabby	Reddish tabby
B102, +H+19, c. 100, no. 1	Beige tabby	Reddish tabby
B102, +H+19, c. 100, no. 2	Beige tabby	Reddish tabby
B102, +H+19, c. 100, no. 3	Beige tabby	Reddish tabby
B102, +H+19, c. 100, no. 4	Beige tabby	Reddish tabby
B102, +H+19, c. 100, no. 5	Beige tabby	Reddish tabby
B102, +H+19, c. 100, no. 6	Beige tabby	Reddish tabby
B102, +H+19, c. 100, no. 7	Beige tabby	Reddish tabby
B102, F6, c. 44, no. 1	Beige tabby	Reddish tabby
B102, F6, c. 44, no. 4	Beige 2/2 twill(?)	Reddish 2/2 twill(?)
B102, +C+6, c. 44, no. 1	Blueish 2/1 twill	Beige tabby
B102, +C+6, c. 44, no. 2	Blueish 2/1 twill	Beige tabby
B102, E7, 38	Beige tabby	Bluish tabby

Table 3. List of textiles with weft-faced bands.



Fig. 7. Example of a decorated fabric with beige stripes and a blue background: *B102, +C+6, c. 44, n°2* (Photo: Émeline Retournard).

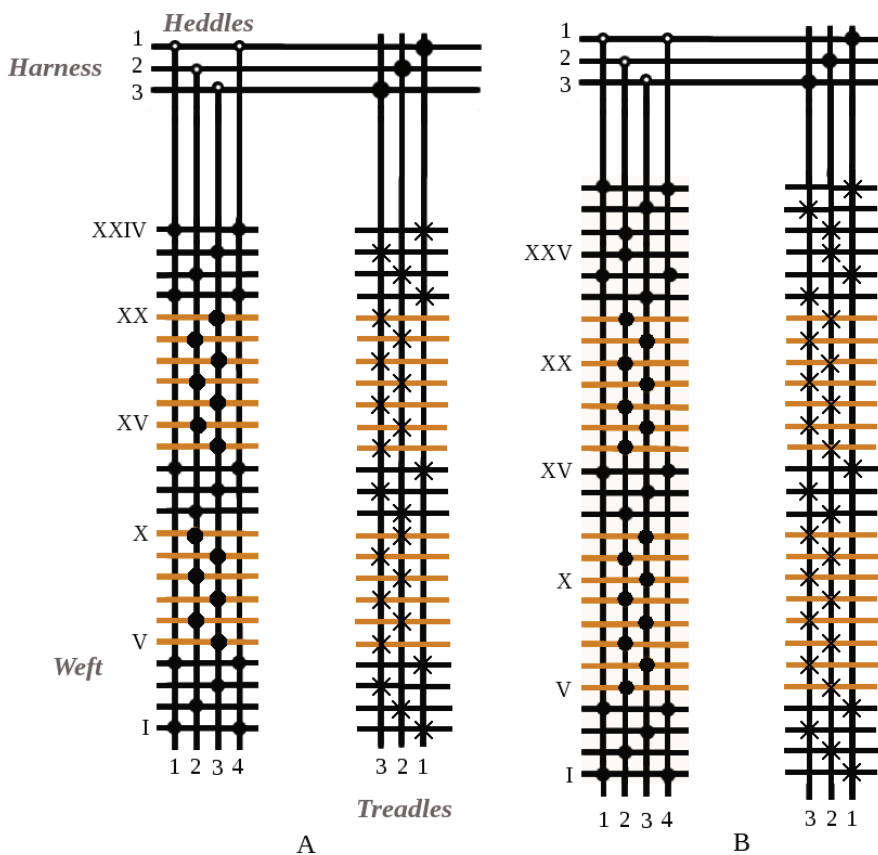


Fig. 8. Weaving schemes of decorated 2/1 weft-faced twills. A: *B102, +C+6, c. 44, n°1*. B: *B102, +C+6, c. 44, n°2*. Point: warp thread up. Cross: Working treadle (Drawing: Émeline Retournard).

### Interpretation

The textiles from zone B102 were found in garbage dumps, in and around washing basins, inside and outside buildings, near pipes and in barite sand (Fig. 12). Seventeen samples were discovered near a domestic hearth inside a construction identified as a shelter for workers. Does the presence of textiles within this ore-washing workshop correspond to a precise technique? Why was this organic material here? Were textiles abandoned or buried purposefully? The study of 445 archaeological textiles highlights both diversity and homogeneity in a corpus found within an industrial context. Were these fragments produced in the village? Was there a commercial network with Brandes-en-Oisans? Who made them: villagers or professionals?

Many details of the textiles from zone B120 allow for hypothesising a domestic textile production for local distribution (medium quality of textiles, weaves, simple selvages and decorations, natural wool colours). Raw material was within range of the villagers. Indeed, a study of the animal bones carried out during the 1990s by C. Olive highlights the presence of *caprinae* in the area (Bailly-Maître and Bruno-Dupraz 1994, 122). These animals could have supplied the village with meat, wool and skins. Villagers could even have selected animals to obtain different coloured fleeces. The discovery of a sheepfold and tools (spindle whorl and thimble) accentuate the hypothesis of a specific farm and a domestic textile production (Bailly-Maître 2008, 46).

### Chemical analyses

Laboratory analyses were conducted by Christophe Moulhéat at the Musée du quai Branly in Paris. These consisted of an observation of fibres with an SEM (Scanning Electron Microscope) and a microscope and were performed in order to observe which chemical elements touch these fibres (Table 6). The SEM confirmed the use of wool, even if the scales of wool were difficult or, in some cases, impossible to detect because of a layer of sediment around the fibres. The surface of fibres was very damaged (Fig. 13). Diameters of fibres were between 18 and 30 microns. These measurements correspond to a fine to medium quality of wool according to Moulhéat. Sample B102, +A+B 5+6, c.2, n°12 differs by having bigger fibres than the others. It may be coarse hair mixed with wool, expressing in this way a medium quality of wool. The analysis of sample B102, +K+33, US 249, 2010-102-69 revealed the presence of human hair. Indeed, even if sediment prevents one from seeing the medulla, the thickness of fibres indicates the result. The low pigmentation shows that although now black, the

Textile ID	Selvedge
B102, +H+20, c. 117, no. 1	Simple
B102, +N+37, c. 403, no. 1	Simple
B102, Bassin sud, c. 43	Simple
B102, A2, c. 53, no. 1	Simple
B102, E7, c. 38, no. 1	Simple
B102, Fosse 112 sud, no.2	Simple
B102, +F+6, c. 44, no. 5	Simple
B102, +F+6, c. 44, no. 5	Two threads taken in the return of the weft

Table 4. List of selvages.

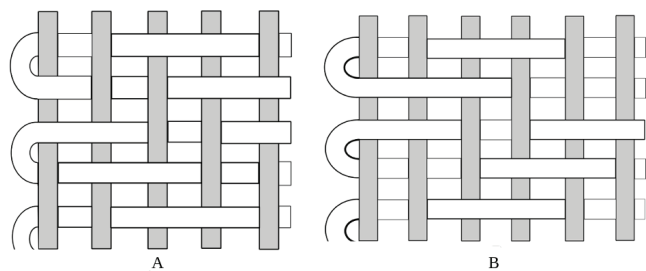


Fig. 9. Schemes of selvages of zone B102. A: simple selvedge. B: simple selvedge with two threads (Drawing: Émeline Retournard).

Textile ID	Embroidery
B102, +G+10, US 96, no. 1	Hole (and a thread remains into another hole?)
B102, Tranchée sondage 96, no. 1	Holes and threads remains
B102, +I+10, US 91, no. 1	Holes (?)
B102, +I+10, US 91, no. 2	Holes and a thread remains
B102, +I+10, US 91, no. 3	Holes
B102, +I+10, US 91, no. 4	Hole (?)
B102, fosse 112 sud, c. 2, no. 11	Holes and threads remains
B102, fosse 112 sud, c. 2, no. 12	Holes and threads remains
B102, fosse 112 sud, c. 2, no. 13	Holes
B102, fosse 112 sud, c. 2, no. 14	Holes (and threads remains into another hole?)
B102, fosse 112 sud, c. 2, no. 15	Holes
B102, fosse 112 sud, c. 2, no. 2	Holes and threads remains (border decoration)
B102, +J+33, US 249, no. 1	Holes
B102, E3, c. 61, no. 1	Holes
B102, E3, c. 61, no. 2	Holes
B102, E3, c. 61, no. 3	Holes
B102, entre mur 277 et 336	Holes

Table 5. List of embroideries.



Fig. 10. Example of embroideries: B102, Fosse 112 sud, n°12 (Photo: Émeline Retournard).



Fig. 11. Example of a selvedge embroidery: B102, Fosse 112\_sud, n°2 (Photo: Émeline Retournard).



Fig. 12. Plan of zone B102 with localisations of textiles by square. Yellow square: one textile, orange square: two-three textiles, light green square: four-five textiles, dark green square: six-seven textiles, brown: ten or more textiles. Basins and pipes are blue (Drawing: Marie-Christine Bailly-Maître. Modifications: Émeline Retournard).



Textile ID	Samples
B102, +A+B 5+6, c. 2, no. 12	Warp thread
B102, +C+6, c. 44, no. 1	Warp Weft Decoration threads
B102, +H+19, c. 100, no. 1	Warp Weft Decoration threads
B102, +K+33, US 249, 2010-102-69	Animal material
B102, +M+21, US 134, z. 183	Plant material
B102, tranchée sondage 96	Plant material and fabric

**Table 6. List of samples for the SEM.**

hairs were blond or light before burial. A strange plant material was also analysed (*B102, +M+21, US134, z.183* and *B102, Tranchée sondage 96*). In macroscopic view, this material appears white and bast while *alveolae* and knots are visible in microscopic view. The plant is neither flax nor hemp.

Several chemical elements were detected on the surface of the fibres. Lead is the most common at 4-48 % according to the samples and the points of analysis. Barium and silicon have a huge percentage too. The other components include carbon, oxygen, magnesium, sulphur, iron, copper, phosphorus, arsenic, chlorine, potassium, bromine, aluminium, titanium and antimony. Barium is a component of barite sand, the main component of the veined ore rock of Brandes-en-Oisans. Silicon is a chemical element of quartz. Sometimes, veined ore barite rock is found melted with quartz (Bailly-Maître 2008, 64). Silver appeared on the screen for just a moment, but

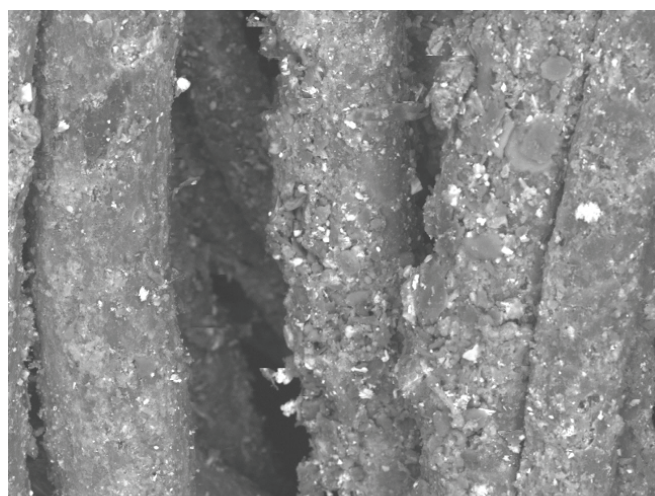
the concentration was too weak to be incorporated in the scale.

The observation of the dyed fibres indicated that none of the fibres were dyed inside and the colours did not soak in the same way everywhere. Fibres were spun and dyed before they were woven. Red and blue were observed under the microscope (Fig. 14). Madder and woad were perhaps used to dye the threads of samples *B102, +C+6, c. 44, n°1* and *B102, +H+19, c. 100, n°1* because of the rural context and large-scale trade of these plants in Medieval Europe (Pastoureau 2000, 63). But it cannot be confirmed without chemical analysis.

#### *Origins and uses of textiles*

Raw material, dyes and embroideries permitted us to postulate that a part of the corpus from zone B102 were fragments of clothing. Because of the cold weather, the villagers of Brandes-en-Oisans needed wool to protect themselves. Twill, the most common weave, is longer and involves a more physical weaving process than tabby does, but it has more positive features. It retains physical heat because of longer floats and it is more resistant than tabby (Guyard-Commien 2011, 13).

According to Dominique Cardon, 2/1 twill is more common in the wool and drapery industry of the Middle Ages (Cardon 1999, 482). Consequently, is the presence of a huge quantity of 2/2 twills in Brandes-en-Oisans a result of local speciality and production? Textiles presenting dyeing and embroidery highlight the clothing taste of the villagers: an aesthetic view created with simple and varying materials. The quest for beautiful clothing must be linked to various bodily ornamentations and cosmetic practices discovered in

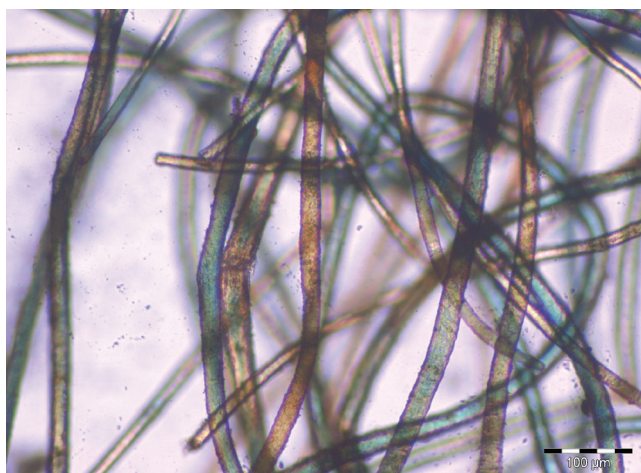
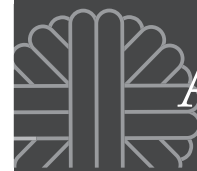


2014/05/06 HL D12.4 x1.0k 100 um



2014/05/06 HL D12.0 x800 100 um

**Fig. 13. Detail of fibres of the warp (left) and weft (right) threads of sample *B102, +C+6, c. 44, n°1* with a SEM (Photo: Émeline Retournard).**



**Fig. 14. Observation of coloured fibres under the microscope: B102, +C+6, c. 44, n°1, decoration thread, weft (Photo: Émeline Retournard).**

the church, the houses and garbage dumps, including belt buckles, brooches, glass pearls, hair pins, tweezers et make-up palettes. Bodily appearance and care were obviously a matter of interest. Leather material reinforced this hypothesis with the types of shoes retrieved, such as a low-cut shoe with a decorated sole and an ankle shoe luxurious slipper (Bailly-Maître and Bruno-Dupraz 1994, 128-132; Bailly-Maître 2008, 50-53).

Zone B102 was a place dedicated to ore washing. Most of the textiles were found in or near washing basins and pipes (Fig. 12). Consequently, a theory suggests that some textiles could have been used for ore-washing. The scales of wool are ideal for use in the catching of specks on the surface of the textile. This method is called *sluice* in French and was already used in antiquity for the washing of gold ore. Georgius Agricola published in 1530 *De re metallica*, a book about mines and metallurgy where this method is illustrated. The process uses a wooden table at a slight angle. Ore powder and water are poured together on the installation. Specks grip onto the surface while the veined ore rocks and water fall down to the table. In *De re metallica*, several etchings depict the recovery of the ore. It could be made using punched or striped smooth wooden tables, subdivided wooden tables or even wooden frames with railings. We also have evidence for methods used in Thuringia, Germany, where workers used smooth as well as rough wooden tables. They may have put fabrics, animal skins, rags and lawn on the tables: fibres, hairs and grass catch particles of ore. Others used sheep and horse skins. Skins and textiles were then washed to recover the specks. Agricola writes about the myth of the Golden Fleece. He explains that people of Colchis put fleeces

into the spring puddles and recovered them covered by specks of gold, inspiring at the same time poets for the Golden Fleece. A picture illustrates this with soldiers dressed in the manner of the 16<sup>th</sup> century in front of a spring waiting for the fleece of a ram in water. It represents Jason and the Argonauts (Fig. 15). These methods can also be used for silver and gems. Concerning the use of textiles, etchings illustrate the *sluice* with fabrics inside (Fig. 16) or outside (Fig. 17) a building. Other methods consist of attaching textiles to a tip-up table (Fig. 18) or the use of nets made of horse hair instead fabrics (Fig. 19; Agricola 1530, 254-265).

Latin is the language of the original text. Textiles are mentioned using words such as *lintea*, *linteis* and *panno*, *pannos*. These words are ambiguous because *lintea* and *linteis* can be interpreted simultaneously as 'fabric', 'plain tabby' and 'flax'. Likewise, *pannos* refers to 'a piece of fabric' or 'rags'. In this way, it is more complicated to know exactly which sort of textiles were being used for the recovery of ore. It is possible that twill, with its longer threads, would catch more silver powder than tabby. Cutting marks indicate a reuse of textile or a transformation. Are these marks proof of an adjustment of textiles for the *sluice* and do the smaller samples represent losses of fabrics? Were the textiles discovered in zone B102 made specifically for ore washing or were they reused for this particular technique? Can decorated fragments be interpreted as portions of reused clothing? Was the dark colour of



**Fig. 15. Etching from *De re metallica*, illustrating Jason and the Argonauts. A: Spring, B: Skin, C: Argonauts (After: Agricola 1530, 263).**



some of the wools useful to differentiate the textile background from specks or is it a deterioration due to time? Agricola explains in *De re metallica* that many workers used a green fabric to more easily distinguish the ore particles on the textile.

As previously mentioned, the textiles of zone B102 were discovered in pipes and in and around basins dug into the ground. That is why the first interpretation of these textiles was that they were used for the washing of silver and lead ore. Microscope analyses revealed significant erosion of the fibres and the presence of lead, barite and silicon, components of the veined ore rock found in mines around Brandes-en-Oisans. Combined action of water and these elements could have caused the erosion of the fibres. Thus, the hypothesis of using some of the textiles for ore washing is strengthened. Nevertheless, should the better-quality textiles be regarded as reused?

A third hypothesis consists in considering that some of the textile fragments were abandoned. Indeed, some fabrics were even found in what came to be understood as garbage heaps. But, to throw away textiles was not conventional and against ancient popular customs: a cloth was typically used until it was worn out (Piponnier and Mane 1995, 28). Were the twisted fabrics used to proof the bottom of the washing basins? Could they have been used as hand and knee protection for workers breaking, sieving and

washing ore or was safety dress only in leather? Could these textiles be remains of workers' clothes (coat, cloak, hat) to protect themselves from the cold winter weather?

### Comparisons

Comparisons between the corpus of zone B102 in Brandes-en-Oisans and other European archaeological textiles are possible and similarities were discovered with a few other medieval textiles. As yet there is no other example of an ore-washing site with textiles.

Excavations in London revealed an important concentration of fabrics as tabbies and twills. As in Brandes-en-Oisans, decorated tabbies with weft-faced bands from the 14th century were found. Bands were monochrome or contained up to three different colours. Red was identified, as well as blue, purple and brown. These fabrics, called 'rays', were woven in England, Flanders, Brabant and northern France. They were discovered in excavations in Amsterdam and Dordrecht (Netherlands), Lübeck (Germany), Novgorod (Russia) and York (England: Crowfoot *et al.* 2001, 52-54). Tabbies with weft-faced bands were also found in Lödöse (Sweden), as a beige tabby with red weft-faced bands or tabbies with several colours in the bands. Twills with weft-faced bands are also visible: 2/1 twills with weft-faced tabby bands or 2/1 twills with weft-faced twill bands (Vestergård Pedersen 2009,



Fig. 16. Etching from *De re metallica*, illustrating the sluice. A: Table, B: Textile, C: Top of the table, D: Pipes, E: Settling tank, F: Rake, G: Tank (After: Agricola 1530, 242).



Fig. 17. Etching from *De re metallica*, illustrating the sluice. A: Top of the table, B: Table, C: Rag (textile), D: Pipes, E: Collection tank for rubbish, F: Tank for textile washing (After: Agricola 1530, 264).



140-145). Are these 'rays' a style of the late Middle Ages and evidence of the distribution of ideas across Europe at this time? In this case, it would suggest that the village in the French Alps was connected with a much larger network.

Brandes-en-Oisans and its archaeological textiles can be compared with other medieval silver mining sites such as Altenberg (Siegerland, Germany). There, silver mines were exploited from the Middle Ages to 1914. The mines were within the territory of four villages and the city of Siegen. Some buildings were found near the mines (including houses and caves). Organic material was also discovered, including wood, leather and textiles. Textiles were found mainly in two mine wells, inside and around the building above. They can be classified into three groups: fabrics, needleworks and felt. Sheep wool was the only raw material recovered. Tabbies, 2/2 twills and 2/1 twills are present in smaller quantities as Brandes-en-Oisans and 2/1 twill is the most common weave. The colours were black, white, beige, deep orange and brown. Dye analyses highlight the presence of madder, lichen, weld, broom, woad and tannins (barks and galls). Tabby weft-faced bands are visible on tabbies and twills. Weft threads are monochrome or two-coloured and more beaten than the background (Vierck 1998, 1-7; 1998, 113-133).

## Conclusion

The study of more than 400 fragments of medieval fabrics from an ore-washing workshop at Brandes-en-Oisans (Isère, France) shows the site's huge potential. The discovery of this organic matter is exceptional because of its typically perishable nature. The localisation of textiles on excavations permitted us to hypothesise about a use of textiles in an antique method to catch ore specks. Laboratory analyses reinforced this hypothesis demonstrating a significant erosion of the surface of fibres and the presence of an important quantities of lead, barite and silicon upon contact with samples. Traces of dyes and embroideries on fabrics led to think about a reuse of clothes for the process of washing. Finally, comparisons with other contexts put Brandes-en-Oisans into a medieval European network. In every instance, the study of these textiles indicates that the people of this little village in the mountains were concerned with their appearance and moved with the times.



Fig. 18. Etching from *De re metallica*, illustrating the sluice. A: Table, B: Wet textiles, C: Bucket, D: Other type of bucket, E: Remains of veined ore rock (After: Agricola 1530, 243).



Fig. 19. Etching from *De re metallica*, illustrating the sluice. A: Taut net, B: Net, C: Tank for textile washing (After: Agricola 1530, 265).



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