Volume XIII ● Issue 2/2022 ● Pages 155–162

INTERDISCIPLINARIA ARCHAEOLOGICA

NATURAL SCIENCES IN ARCHAEOLOGY

homepage: http://www.iansa.eu

# Petro-Archaeometric Study of Pre-Roman Pottery from the Archaeological Site of Bec Berciassa (Roccavione, Cuneo, North-West Italy): Technological Remarks from Petrographic Study of Tempers

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*ARTICLE INFO*

*Article history:*
Received: 21st March 2022
Accepted: 8th August 2022

DOI: http://dx.doi.org/10.24916/iansa.2022.2.5

*Key words:*
ceramics
Pre-roman production
northern Italy
raw materials
production technology
petrography

*ABSTRACT*

The petro-archaeometric study of ceramics from the Rittatore excavations, Bec Berciassa archaeological site, was carried out on pottery sherds attributed to an older phase dating back to the Late Bronze Age. This collection represents a small sampling of pottery and the chronology of most of this material is homogeneously ascribable to a period between the 6th and the beginning of the 4th century BC (Iron Age). In addition to the archaeometric study, a geological survey highlighted the resources of the area potentially useful for the development of prehistoric communities, including resources that could be used for ceramic production.

A thin section study under optical microscope distinguished five ceramic mixtures. They are mostly coarse-grained, hiatal, and serial-textured, calibrated with the addition of fillers. The fine matrix is homogeneous in composition, although with compositional variations in $Fe_2O_3$. Therefore, it is possible to hypothesise a single source of supply. The different types of filler can be traced back to minerals and rocks found outcropping within the basins of the Gesso and Vermenagna rivers and thus potentially present as pebbles in their beds. Calc-schists, sparitic calcite, magmatic rocks (granites and aplites), and sericite-schists have been used since the Bronze Age; quartz sandstones and quartzites are only present in Iron Age pottery. At a macroscopic level, all these filler agents are light in colour, tending to white, almost as if the colour and homogeneity of the geological material were a criterion of choice dictated more by tradition and know-how rather than by any particular technological choice.

## 1. Introduction

The Bec Berciassa archaeological site is the most important protohistoric settlement in the Maritime Alps, Cuneo district. It is situated at the confluence of the Gesso and Vermenagna rivers, at 692 metres asl (Figure 1), overlooking the surrounding valleys and lying along transalpine routes that have been used since the late prehistoric period. Before the region was Romanised in the 2nd century BC, this hill had long been occupied by the ancient Ligurian tribes from the Late Bronze Age 1550–1200 BC.

The discovery of the archaeological site dates back to 1931, when Rittatore Vonwiller identified and excavated the traces of a "prehistoric village" (Rittatore Vonwiller, 1952). The relevance of the archaeological site for the reconstruction of the history of the territory and its valorisation has been supported by the studies carried out in following years by the Soprintendenza Archeologica del Piemonte (Ferrero, and Venturino Gambari, 2008) and the very recent survey and excavation campaigns (2017–2019) promoted by the Municipality of Roccavione (Cuneo) (Cesana *et al.*, 2018; Rocchietti and Cesana, 2018, Cesana and Padovan, 2019).

The study of the pottery individuates an older phase dating back to the Late Bronze Age represented by a small sample of ceramics. At the same time, the chronology of most of this material is homogeneously ascribable to a period between the 6th and the beginning of the 4th century BC (Iron Age).

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**Figure 1.** Location of the Bec Berciassa archaeological site. Points 1, 2 and 3 show the sampling points of the geological raw materials.

Excavations conducted in 2018 and 2019 unearthed a large number of pottery pieces, nearly 300, but this preliminary study focused mainly on historical finds from the Rittatore excavations. The ceramic bodies themselves contain significant information about the production technology used to make them (Maggetti, 1982; Maggetti, 1994; Freestone, 1995; Quinn, 2013; Montana, 2020). Their detailed study, through a petrographic approach, allows the collection of information concerning the technology followed for the realisation of the mixtures: the raw materials that were used for their production, and where these raw materials were collected.

In this study, the petrography of the ceramics was conducted by focusing on the textures of the mixtures and aiming the petrographic reading toward the coarsest parts of the mixture, *i.e.*, both the mono- and polymineralic grains. Quantity, shape, rounding, sorting, and state of conservation of the grains are textural parameters that, when interpreted together with the petrography of the grains, allow us to reconstruct many steps related to the production chain (Eramo, 2020; Gualtieri, 2020).

To better understand the manufacturing, we have made a survey of geological materials potentially useful for the production of ceramics. In the area of interest for the archaeological site, there is a geological formation known as "Calc-schists with Green Stones" (or "Calc-schist Complex" Unit), a unit outcropping that extends over the lower slopes of the Vermenagna, Stura and Grana Valleys (Montaldo Calc-schists) and overlaps with that known as Brianzonese Unit (Ormea Unit). The different rocks mentioned condition strongly and differently the hydrography, which therefore differs locally based on the lithotypes encountered by the water and their location: the hydrographic network has its maximum development in the outcropping area of schists (non-porous); correspondingly in the calcareous lithologies (porous), however, the hydrology reduces above 750 m, where these lithotypes dominate, and infiltration and an underground circulation prevail, as the surface hydrography almost disappears. All of this has certainly conditioned the anthropisation of the site and not only related to the general conditions of habitability, but especially concerning the availability of water and the exploitation of raw materials. The survey and sampling of geological materials are the basis for establishing technical choices for ceramic production.

Two main archaeological questions drove the goals of this paper: What was the production technology of the ceramics of Bec Berciassa? Which raw materials were used?

## 2. Materials and methods

All samples from the "Rittatore excavations" were analysed with a lens, using a non-invasive approach. The results of this first survey allowed the identification of distinct groups based on the coarse component of the mixture. On this basis, a selection of finds, representative of each group, was carried out to realise petrographic thin sections. A total of 17 thin sections, polished, were prepared (Table 1).

The polished thin sections were studied under optical microscopy using an Olympus BX51 UV polarised light

**Table 1.** The table shows the values of the textural and compositional parameters (morphological features and petrography of the rock fragments) of the ceramic bodies. The evaluation was carried out on thin sections, under an optical microscope. Wentworth class: VCG = very coarse grain, CG = coarse grain, FG = fine grain; sorting: VWS = very well-sorted, WS = well-sorted, MS = moderately-sorted, VPS = very poorly-sorted, PS = poorly-sorted; roundness: 0.1= very angular, 0.3 = angular, 0.5 = sub-angular, 0.7 = rounded, 0.9 = well-rounded (Krumbein and Sloss, 1963).

| Samples | | | Temper features | | | | | Petrography of grains % | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Sample code** | **Age** | **Description** | **Thickness (cm)** | **Wentworth class** | **% (Vol)** | **Sorting** | **Krumbein roundness** | **Magmatic intrusive** | **Quarzite** | **Sericitic schists** | **Calcite / dolomite** | **Calc-schists** | **Sandstones** | **Clay pellets** |
| BBR1 | bronze age | Rittatore archaeological excavation (1951); ripiani | 1 | CG | 35 | MS | 0.1 | 50 | 0 | 20 | 50 | 0 | 0 | 0 |
| BBR2 | bronze age | Rittatore archaeological excavation (1951); ripiani | 0.75 | VCG | 10 | VPS | 0.3 | 80 | 0 | 10 | 0 | 0 | 0 | 10 |
| BBV1067 | middle iron age, V B.C. | Rittatore archaeological excavation (1951); vigna; bowl | 0.65 | FG | 20 | WS | 0.7 | 0 | 0 | 0 | 0 | 0 | 0 | 100 |
| BBV1063 | middle iron age, V B.C. | Rittatore archaeological excavation (1951); vigna | 0.58 | VCG | 30 | VPS | 0.1 | 5 | 0 | 80 | 0 | 0 | 15 | 0 |
| BBV1078 | middle iron age, V B.C. | Rittatore archaeological excavation (1951); vigna; bowl | 0.63 | CG | 10 | MS | 0.5 | 5 | 0 | 0 | 0 | 0 | 0 | 95 |
| BBV1075 | middle iron age, V B.C. | Rittatore archaeological excavation (1951); vigna | 0.83 | VCG | 20 | VPS | 0.1 | 80 | 0 | 20 | 0 | 0 | 0 | 0 |
| BBV1017 | middle iron age, V B.C. | Rittatore archaeological excavation (1951); vigna | 0.84 | VCG | 30 | VPS | 0.1 | 10 | 10 | 70 | 0 | 0 | 0 | 10 |
| BBV1107 | middle iron age, V B.C. | Rittatore archaeological excavation (1951); vigna | 0.88 | VCG | 10 | VPS | 0.1 | 0 | 0 | 90 | 0 | 0 | 0 | 10 |
| BBV1070 | middle iron age, V B.C. | Rittatore archaeological excavation (1951); vigna | 0.68 | VCG | 25 | VPS | 0.1 | 10 | 10 | 80 | 0 | 0 | 0 | 0 |
| BBR1054 | iron age | Rittatore archaeological excavation (1951); ripiani | 0.78 | CG | 30 | MS | 0.3 | 70 | 0 | 0 | 20 | 10 | 0 | 0 |
| BBR370 | iron age | Rittatore archaeological excavation (1951); ripiani | 1.25 | VCG | 10 | VWS | 0.1 | 0 | 0 | 0 | 0 | 100 | 0 | 0 |
| BB52 1057 | iron age | Rittatore archaeological excavation (1951); ripiani | 0.75 | CG | 10 | MS | 0.5 | 5 | 0 | 0 | 0 | 0 | 0 | 95 |
| US22-BB19-43 | iron age | 2019 excavation campaign | 0.75 | VCG | 20 | VPS | 0.3 | 10 | 0 | 40 | 0 | 50 | 0 | 0 |
| US15-BB19-35 | iron age | 2019 excavation campaign | 0.75 | VCG | 25 | VPS | 0.1 | 15 | 0 | 10 | 0 | 75 | 0 | 0 |
| US22-BBV2019-32A | iron age | 2019 excavation campaign | 0.55 | CG | 3O | MS | 0.5 | 20 | 70 | 10 | 0 | 0 | 0 | 0 |
| US15-BB19-34 | iron age | 2019 excavation campaign | 0.88 | VCG | 30 | PS | 0.1 | 20 | 60 | 20 | 0 | 0 | 0 | 0 |
| BB2017 UR134/1 | iron age | 2017 excavation campaign | 1.1 | VCG | 20 | VPS | 0.3 | 70 | 0 | 20 | 0 | 10 | 0 | 0 |


**Figure 2.** Counting and classification of pebbles from the Vermenagna and Gesso rivers. A: point counter used for the statistical survey of pebbles; B: most frequent pebbles in the coarse deposits of the river beds.

(OM) petrographic microscope with Olympus UC30 digital camera.

The abundance, distribution, and shape of the inclusions were evaluated by comparative charts, following the protocol given in Quinn (2013).

A scanning electron microscope with energy dispersive electron microanalysis (SEM-EDS) was used to study the matrix. The SEM used was a Tescan FE-SEM (Mira 3XMU-series), equipped with an EDAX energy-dispersive spectrometer (silicon drift detector energy-dispersive X-ray – spectrometer – SDD-EDS). The operating conditions were: 20 kV accelerating voltage, 12 mA beam current, 15.8 mm working distance, counts of 100 s per analysis, and dead time of approximately 25%. The measurements were processed using the EDAX Genesis software, and the data was obtained using the ZAF correction. Samples were prepared by C-coating from graphite (C).

The geo-archaeological survey was extended beyond the archaeological site and directed to the search for materials comparable to those found in the ceramic bodies, specifically the materials used as fillers. A study was carried out on the pebbles of the Vermenagna and Gesso rivers, which were considered potential sources of useful geological material for the treatment of ceramic soils. In the riverbed near the archaeological site, the Gesso and Vermenagna rivers still have a torrential feature. Their recent deposits, and those on some of the higher terraces of the active riverbed, rarely show the deposition of sandy deposits. Outcropping sediments are generally gravels, pebbles, and cobblestones (Figure 2A). One hundred river pebbles and cobblestones were counted and catalogued according to rock type. The counting points are shown in Figure 1: in the Vermenagna stream bed, upstream of the confluence with the Gesso River (point 2 in Figure 1), and along the Gesso River (point 3 in Figure 1). Counting was conducted using a 1 m-sided counting grid, divided into 10 cm squares. Pebbles corresponding to the crossing points of the grid rows were collected (Figure 2A).

## 3. Results

### 3.1 The pottery fragments

The texture of the artifacts can be defined as hiatal or serial (Table 1), according to Maggetti (1994). The mixtures were coarse grained to very coarse grained (Table 1); only one artifact being fine-grained, despite having a consistent thickness (BBV1067, in Table 1).

Temper grains are mostly rock fragments; mono-mineral grains correspond to the same minerals found in rock fragments. Grains commonly had a low roundness, with indented edges (roundness between 0.1–0.7), only the grains of metamorphic rocks having more rounded shapes, particularly sericitic schist grains, which are rich in sericite, and consequently have a more plastic behaviour than other grains. The temper ranges from very poorly sorted to well-sorted (Table 1; Figure 3). Grains are mainly well-preserved and unaltered. The morphological features of these grains led to the hypothesis that there had been an intentional addition of filler to correct the plasticity of the

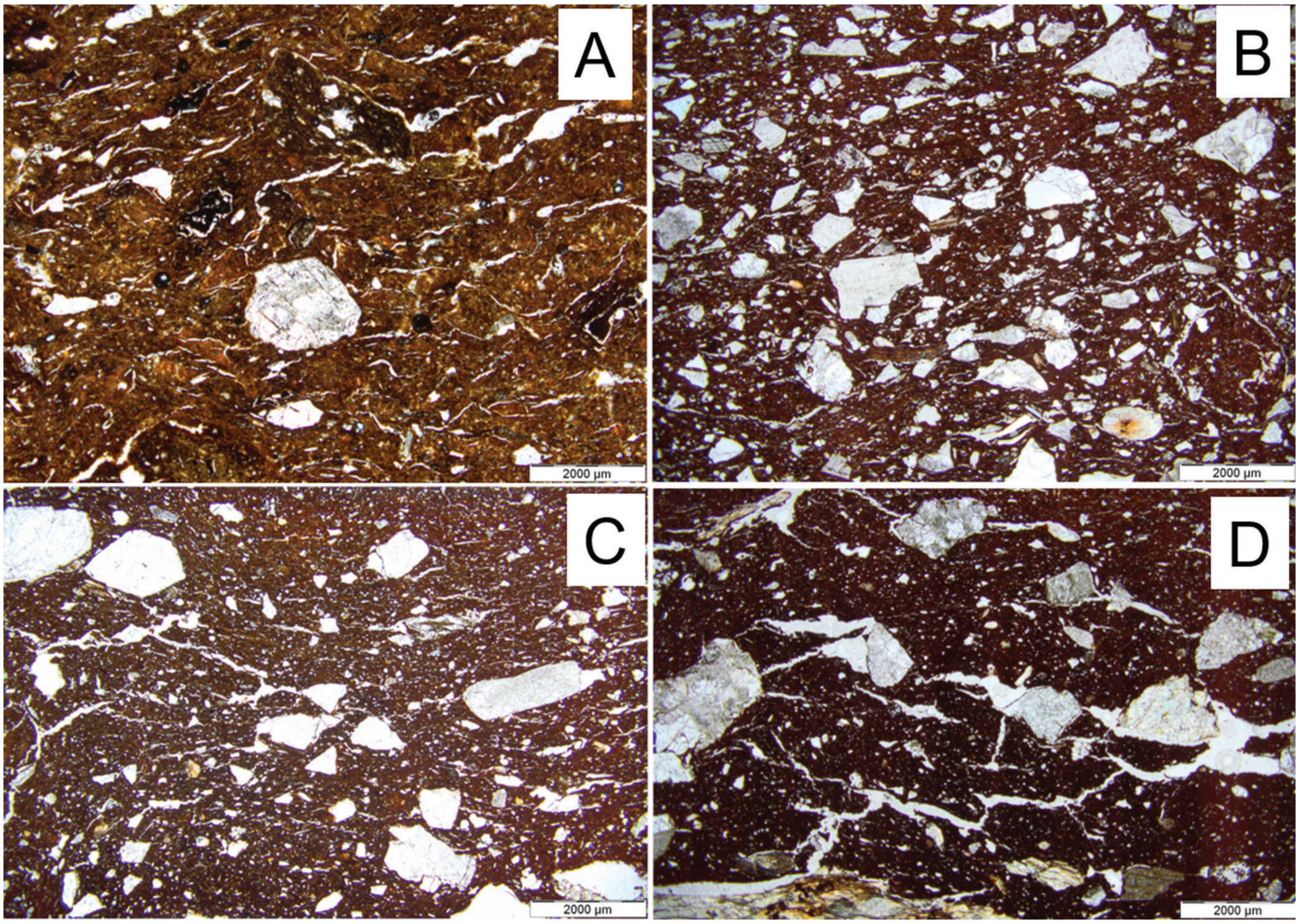


**Figure 3.** Optical microscopy imagery (PPL = plane-polarised light) of ceramic textures, some examples. A: hiatal texture with temper addition that is less than 10 %; B: serial texture with temper up to 35 %, with roundness of fragments very low; C and D: hiatal texture with temper approximately 25–25 %.

clay matrix. In particular, well-preserved grains with angular shapes, unsorted, represent the result of crushing rocks and the degree of sorting corresponds to the subsequent process of a particle size selection of the crushed material. The percentage of filler varies for each artifact (Figure 3). In Figure 3A, one temper addition is less than 10% and such a percentage can

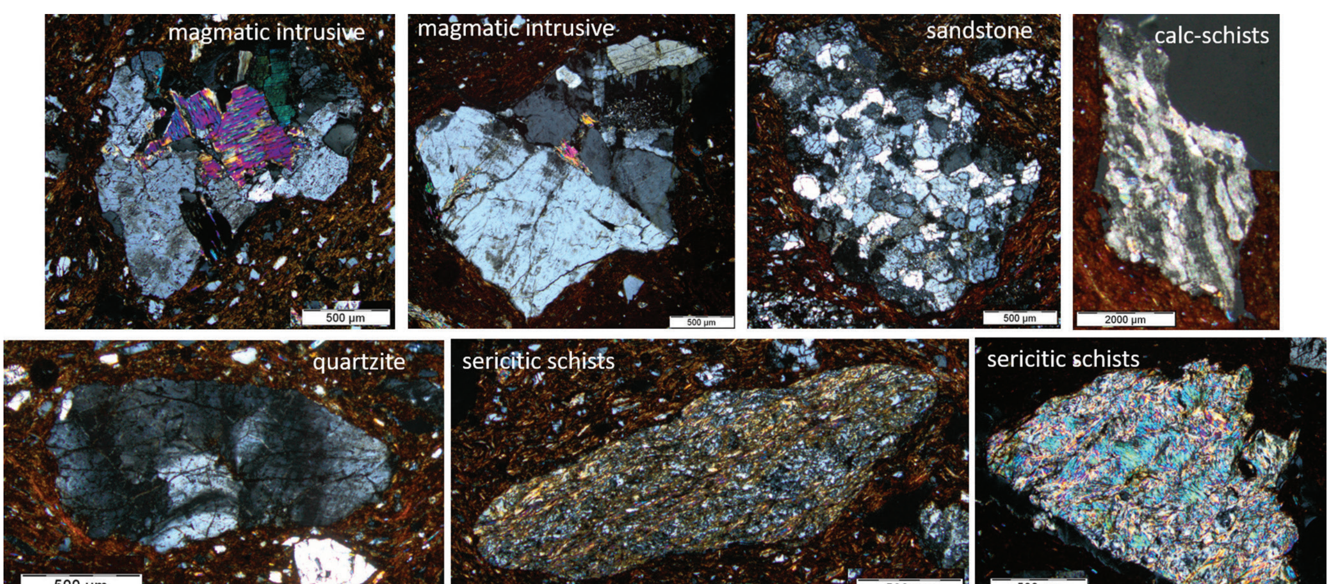


**Figure 4.** Optical microscopy imagery (XPL = cross-polarised light). Petrographic characterisation of the rock grains that form the ceramic temper.

have no technical function in the ceramic body because it does not change the plasticity of the ceramic mixture; on average, the added filler was found to have percentages ranging from 20% (Figures 3C and 3D) up to 35% (Figure 3B). Table 1 shows the distribution of the different types of rock fragments in the ceramic temper.

The most frequent rock fragments are related to magmatic intrusive rocks (Figures 4A and 4B) and metamorphic rocks (Figures 4D, 4F and 4G). Among the latter, sericitic schists (Figures 4F and 4G) and calc-schists (Figure 4D) prevail. It is difficult to give a precise petrographic classification of the grains because the association of minerals is sometimes partial. Considering the fragments of magmatic rocks, the diagnostic character of the hypidiomorphic texture of intrusive rocks is evident, but it is impossible to make even a qualitative assessment of the quantity of the minerals constituting the original rock. It is, however, possible to detect the partial association of minerals, such as: quartz + K-feldspar + biotite ± chlorite, K-feldspar + amphibole ± chlorite, quartz + K-feldspar, quartz + K-feldspar + plagioclase + biotite. These types can be traced to the Argentera Massif, from which the Gesso River originates.

Sericitic schists and calc-schists outcrop extensively in the hydrographic basin of the two rivers.

Pottery sherds with a mixture containing quartzite (Figure 4E) or quartz sandstone fragments (Figure 4C) are less abundant. Only sample BBR1, Bronze Age, contains a significant amount of sparitic calcite fragments as a filler (Table 1). In ceramic mixtures, different rock fragments are often associated with each other; in fact, a single-component filler has rarely been observed. The most common situation shows a dominant lithotype within the temper (in percentages of more than 50% up to 95%) associated with small percentages, sometimes only 5%, of grains of other lithotypes (Table 1). Few artefacts are devoid of rock fragments (Table 1). In these artefacts, the filler is represented by clay pellets which have the same composition as the fine matrix (Table 2). The rock fragments stand for less than 5% and are represented by intrusive rocks. These clay pellets, which can sometimes represent 100% of the non-plastic fraction of the ceramic body, may result from the use of soil that was originally partially consolidated and then poorly worked. In these bodies, the texture is serial, according to Maggetti (1994).

**Table 2.** Chemical composition of clay matrix and clay pellets.

| Samples | $Na_2O$ | MgO | $Al_2O_3$ | $SiO_2$ | $P_2O_5$ | $K_2O$ | CaO | $TiO_2$ | MnO | $Fe_2O_3$ |
|---|---|---|---|---|---|---|---|---|---|---|
| BBV1017 clay matrix | 0.4 | 2.5 | 30.5 | 46.5 | 1.3 | 3.0 | 1.4 | 0.8 | 0.1 | 13.4 |
| BBV1107 clay matrix | 0.3 | 2.6 | 24.4 | 55.7 | 1.1 | 2.4 | 1.1 | 0.6 | 0.3 | 11.4 |
| BBV1070 clay matrix | 0.3 | 2.7 | 31.0 | 44.1 | 1.2 | 2.8 | 1.4 | 0.8 | 0.4 | 15.1 |
| BBR1054 clay matrix | 1.4 | 3.7 | 26.9 | 44.5 | 1.4 | 2.0 | 1.2 | 0.6 | 0.2 | 17.8 |
| BBV1067 clay matrix | 0.3 | 2.4 | 29.9 | 42.6 | 3.4 | 2.6 | 2.7 | 1.0 | 0.1 | 14.6 |
| BBV1063 clay matrix | 0.5 | 2.3 | 31.4 | 44.8 | 2.0 | 2.6 | 1.7 | 1.1 | 0.0 | 13.4 |
| BBR370 clay matrix | 0.4 | 2.9 | 31.6 | 44.9 | 1.4 | 3.2 | 1.6 | 0.9 | 0.1 | 12.9 |
| BB52 clay matrix | 0.3 | 1.9 | 33.3 | 38.8 | 3.3 | 1.8 | 2.3 | 0.8 | 0.1 | 17.0 |
| BBV1078 clay matrix | 0.3 | 2.7 | 26.7 | 48.4 | 3.5 | 2.9 | 1.6 | 0.7 | 0.0 | 13.1 |
| BBV1075 clay matrix | 0.3 | 3.4 | 29.9 | 42.6 | 4.3 | 3.4 | 1.9 | 0.9 | 0.1 | 13.0 |
| US22-BB19-43 clay matrix | 0.3 | 2.4 | 32.4 | 40.6 | 2.5 | 3.6 | 1.2 | 0.9 | 0.0 | 16.1 |
| US15-BB19-35 clay matrix | 0.3 | 2.5 | 30.6 | 43.6 | 2.5 | 3.1 | 1.3 | 0.9 | 0.1 | 14.9 |
| BB2017 UR134/1 clay matrix | 0.5 | 2.4 | 28.6 | 43.8 | 4.6 | 2.3 | 3.2 | 1.1 | 0.2 | 13.1 |
| BBV1067-1 clay pellets | 0.2 | 2.1 | 32.9 | 39.3 | 3.1 | 2.0 | 2.1 | 0.8 | 0.0 | 17.1 |
| BBV1067-2 clay pellets | 0.2 | 1.7 | 32.8 | 37.9 | 3.7 | 2.0 | 2.8 | 0.8 | 0.1 | 17.3 |
| BBV1067-3 clay pellets | 0.2 | 1.8 | 32.4 | 40.4 | 2.1 | 2.3 | 2.5 | 0.9 | 0.0 | 17.1 |
| BBV1107 clay pellets | 0.3 | 1.6 | 33.4 | 37.5 | 3.9 | 2.0 | 2.6 | 0.9 | 0.1 | 17.4 |
| BBV1017 clay pellets | 0.2 | 1.8 | 32.2 | 40.4 | 2.5 | 2.2 | 2.4 | 1.0 | 0.1 | 17.1 |
| BB52 1057 caly pellets | 0.3 | 2.0 | 32.4 | 38.6 | 3.8 | 2.3 | 2.7 | 0.8 | 0.2 | 16.8 |
| BBV1078-1 clay pellets | 0.5 | 3.0 | 21.9 | 23.5 | 9.8 | 2.5 | 18.3 | 0.9 | 13.0 | 6.5 |
| BBV1078-2 clay pellets | 0.2 | 2.2 | 25.2 | 53.5 | 2.7 | 2.9 | 1.3 | 0.7 | 0.0 | 11.1 |
| BBV1078-3 clay pellets | 0.3 | 2.4 | 30.2 | 44.6 | 2.0 | 3.6 | 1.1 | 1.2 | 0.0 | 14.5 |
| BBR2 clay pellets | 0.7 | 2.7 | 25.5 | 43.5 | 1.9 | 5.7 | 11.5 | 1.4 | 1.3 | 5.3 |
| BR1 clay matrix | 0.4 | 3.1 | 30.8 | 44.0 | 0.3 | 3.4 | 0.2 | 0.7 | 0.0 | 17.1 |
| BR1bis clay matrix | 0.2 | 2.9 | 30.8 | 44.2 | 0.4 | 3.3 | 0.2 | 0.7 | 0.0 | 17.2 |
| BR2 clay matrix | 0.2 | 3.2 | 26.3 | 48.8 | 0.3 | 3.6 | 0.5 | 0.9 | 0.1 | 15.7 |

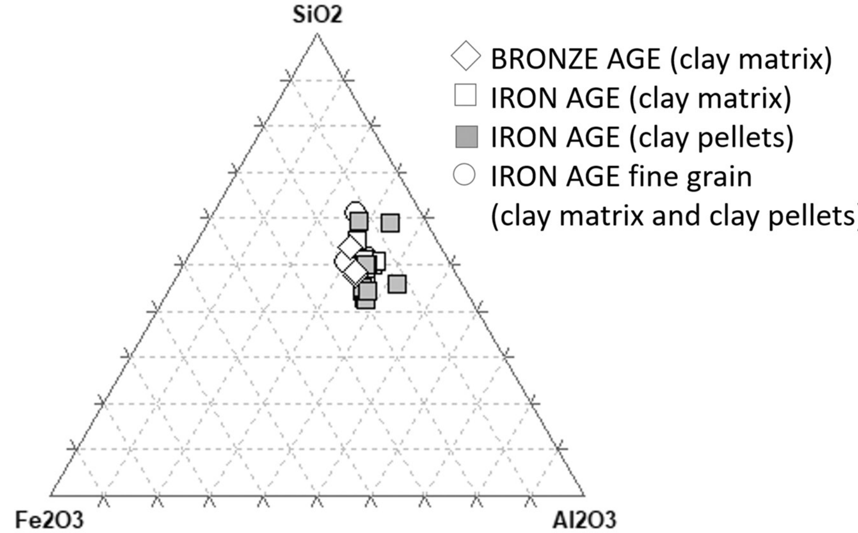


**Figure 5.** Ternary diagram $SiO_2$ – $Fe_2O_3$ – $Al_2O_3$. The chemical composition of the clay matrix is the same as that of the clay pellets. This composition does not change from Bronze Age ceramics to Middle Iron Age ceramics.

The chemical composition of the clay matrix was detected by EDS on an area of 100 X 100 microns. The data shown in Table 2 represent the average of 3 measurements. The clay matrix showed high content of $Al_2O_3$ and $SiO_2$ and consistent values of $Fe_2O_3$. The CaO content varied from a minimum of 0.2 wt% to a maximum of 18 wt%. The presence of $P_2O_5$ in Middle Iron Age artefacts is ubiquitous (Table 2). However, the presence of phosphorus, and partially the content of CaO, are often related to secondary processes occurring in the archaeological deposit in the post-burial phase (Lemoine and Picon, 1982; Buxeda i Garrigós, 1999; Maritan and Mazzoli, 2004; Schwedt *et al.*, 2004; Fabbri and Gualtieri, 2013; Maritan, 2020 and references therein). The clay matrix is always the same in all the samples, from the Bronze Age production to the Middle Iron Age production (Figure 5).

### 3.2 The pebbles of the Vermenagna and Gesso rivers.

The pebbles of the Vermenagna and Gesso riverbeds are mainly intrusive rocks, such as granites, aplites and granodiorites, and metamorphic rocks. Among the metamorphic rocks, schists are the most abundant, calc-schist, mica schists and sericitic schists. Intrusive and metamorphic rocks account for 70% of the pebbles. Quartzites, sandstones, tuffaceous sandstones (following the petrographic classification by Schmid, 1981), and volcanic rocks are present in a smaller percentage. Carbonate rocks, mainly dolomite, are the least common (Figure 2B).

## 4. Discussion

The petrographic studies on the coarse ware ceramics from the Bec Berciassa archeological site, carried out on thin sections, have allowed many clues to be gathered for reconstructing the technological steps at the basis of production. The survey and sampling campaign of the area surrounding the archaeological site was targeted at potentially useful materials for ceramic production, any possible leads to the identification of the sources of raw materials, and at determining whether the pottery was locally produced or from another cultural context.

Based on the petrographic and modal features, five types of mixtures were identified, all of which were made from an iron-rich clay matrix with crushed rocks added as filler:

1. Fe-rich clay matrix + intrusive rocks (granite and aplite) ± calcite/dolomite ± sericitic schists;
2. Fe-rich clay matrix + sericitic schists ± sandstones, ± quartzite ± intrusive rocks;
3. Fe-rich clay matrix + calc-schists ± sericitic schists;
4. Fe-rich clay matrix + quartzite ± intrusive rocks ± sercitic schist;
5. Fe-rich clay matrix with clay pellets.

All the lithologies found in the temper of the pottery are present in the pebbles collected from the riverbeds of the Vermenagna and Gesso rivers.

The mixtures show no correlation with shape, function and decoration.

In the production of the ceramic bodies, there is one aspect that does not fit with an adjustment to the plasticity of the mixtures. Looking at the petrography of the fillers, it can be seen that there are always other types of crushed rocks associated with the most abundant lithotype. These rocks are at a low percentage (<5–7% to 10%) and their voluntary addition does not change the functional characteristics of the filler. The clay matrix is a Fe-rich clay used continuously from the Bronze Age to the Middle Iron Age. This continuity of use, combined with the evidence that its composition remains the same for all artefacts, supports the hypothesis that it is a local soil. In fact, a reddish palaeosol outcrops at the contact between the “grey limestone formation” and the sericitic schists. This geological deposit could be the source of supply of the earth used in production. However, the conducted survey of clay deposits was more complex than the study of filler supply sources. A survey for the geologic deposits that could have consistently supplied the clayey raw material over this long period of time is presently in progress. It is therefore very probable that the technology of production of the pottery was very simple and that the mixture was only one, and this remained constant over a long time. We can say that the plastic fraction of the mixture is a Fe-rich clay deposit, and probably local given the continuity of supply. Moreover, its composition remained constant over historical time. Furthermore, crushed pebbles that were available in the riverbeds of the Gesso and Vermenagna rivers were then added to this clay matrix.

The filler was probably obtained by heating the pebbles and then their subsequent abrupt cooling. The filler would thus undergo particle size selection.

## 5. Conclusion

The production of pottery at the Bec Berciassa archaeological site was made with local geological materials: a red clay (Fe-rich clay), to which pebbles from the rivers Vermenagna and Gesso were added after being appropriately crushed. One may suppose a production sequence that first has a treatment of the pebbles, heating and then a thermal shock to obtain their crushing, and then maybe also a size selection to remove the fine fraction. This would explain the hiatal texture of the artefacts.

A curious aspect noted from our study is that most of the lithotypes used as fillers always consist of light (white) rocks.

The supply of raw materials used remained constant over a long period, from the Bronze Age to the Middle Iron Age.

## Acknowledgements

This paper is part of the research activities of the project “At the origins of alpine culture: Bèc Bërchasa, the restoration and promotion of a protohistoric settlement”, strongly supported by the Municipality of Roccavione and by the Compagnia di San Paolo Foundation, CRT Foundation, and Buzzi Unicem. The authors are grateful to all these public and private institutions for their support. We would also like to thank the Mibact – Soprintendenza Archeologica Belle Arti e Paesaggio per le provincie di Alessandria, Asti e Cuneo for their fruitful scientific and organisational exchanges. The authors thank the reviewers for their suggestions that improved the completeness of the paper.

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