Ceramic petrography analysis of Gallo-Belgic ware imitation from Sint-Maria-Oudenhove

FLEPOSTORE Ceramic Report 01

REPORT & ANALYSIS DETAILS

Site	Sint-Maria-Oudenhove, Faliestraat
Site code	SIFA015
Permit code	2015/196
Excavation date	2015-2016
Features	pottery dump in kiln firing chamber (SP161) pottery dump in pit next to kiln (SP287)
Find numbers	286, 290 (2x)
Chronology	Roman, 1st century
Material	Common reduced ware
Pottery type	Gallo-Belgica ware imitation
Fabric details	Terra Nigra-like fabric
Samples	n=3: A0031, A0032, A0033
FLEPOSTORE ID	5.RE.BE.0001/0002/0003
Analysis	Material characterization
Report date	04/12/2020
Analyzed by	Vince Van Thienen

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INTRODUCTION

A Roman pottery production site was located at Sint-Maria-Oudenhove – Faliestraat (East-Flanders, Belgium) dating to the Flavian period (ca. 69-96 CE). The pottery recovered from the pottery dump in the firing chamber of an abandoned kiln can be described as common reduced ware that has been interpreted as Gallo-Belgic ware imitation with a Terra Nigra-like fabric (Vanholme 2016; Vanholme et al. 2016). Encountered pottery vessels were identified as Holwerda types 26, 27, 30.

Four samples were selected for the FLEPOSTORE Flemish Pottery and Stone Reference Collection. This report contains the descriptions of thin sections of three samples, as well as a brief note on the observed technological indicators and potentially extracted clay sources. The details of these samples can be found at Flepostore - https://www.flepostore.ugent.be/ceramics/5-re-be-0003.

The petrographic descriptions and photomicrographs were made by using an Olympus BX41 microscope with polarizing filters at the Department of Archaeology, Ghent University.

SUMMARY DESCRIPTION

The sampled pottery consists of a brown ceramic body with a dark brown edge. The main fabric (figs. 1, 2) is characterized by a semi-heterogeneous matrix with high optical activity and moderately porosity. The main mineral constituents are predominantly quartz inclusions and frequent inclusions of sedimentary rock, glauconite and iron oxides. Commonly observed are muscovite mica, feldspars and semi-plastics or clay pellets. Additional a singular weathered amphibole or pyroxene has been observed. The inclusions are mainly rounded to sub-rounded of which the coarse fraction ranges between medium fine and fine sand (ca. 100-500 µm) and the fine fraction between very fine sand and silt (ca. 40-100 µm). Overall, the fabric is (moderately) well sorted, single spaced and moderately to poorly orientated. The distribution is only slightly bimodal with overlap in the very fine sand class, indicating that the sand fraction is most likely inherent to the selected clay, rather than added as a temper.

TECHNOLOGICAL INDICATORS

The orange-red color of the fabric is the result of iron oxidization during the firing of the pot. The high optical activity indicates that the firing temperature was below 800-850°C (Quinn 2013, 191). The orange-red to red-brown glauconite indicates a temperature between ca. 500-700° C (Haaland et al. 2017). In general, the thin sectioned sherds demonstrate a rather even coloration in the main fabric, indicating an even distribution of temperature in the kiln.

The dark brown color of the edge of the sample does not appear to be a slip since it demonstrates no compositional differences. The color distinction can be the result of surface working or a change in atmospheric conditions at the end of the baking process, possibly by closing the kiln or smothering the pottery with organic material, resulting in a darker surface color than the body of the paste.

No added temper was observed. The unimodal distribution of inclusions and equal roundness of the quartz minerals indicate that a (light) sandy clay was selected. The sand fraction is thus considered to be naturally present in the clay.

In one sample (A0032), a few inclusions of organic matter can be observed. A singular inclusions can be identified as charcoal or burned plant matter. This also is likely to have been present in the clay, rather than have been added as a tempering agent.

Semi-plastics and clay pellets are general indicators of unsuccessful mixing or clay refinement in that part of the paste, which causes uneven drying between sections with different compositions with higher or lower iron content, or finer or coarser mineral structures. The (semi)plastics then become surrounded by drying cracks and are clearly separated from the main fabric. Clay pellets can be intentionally added as a temper, similar to grog (*chamotte*), to coarsen a fine clay. Given the abundance and complete distribution of the sand fraction throughout the thin section, it is more likely that also the clay pellets and semi-plastic clay zones are part of the natural clay. As are the iron oxides.

In addition to a few quartz minerals of coarse sand grain size (A0032), it can be concluded that pottery is made with a sandy clay that has not been thoroughly cleaned before shaping the pots, leaving a variety of coarse inclusions in the fabric. The lack of cleaning might be intentional.

PROVENANCE INDICATIONS

The abundance of quartz coinciding with sedimentary rocks, chert, feldspars and muscovite mica (only for main fabric) indicates that a sedimentary Tertiary sandy clay was used for both the main fabric and slip. The presence of glauconite, muscovite mica and sand inherent to the clay indicate that from the surrounding area of Sint-Maria-Oudenhove the formations of Maldegem and Gentbrugge (members of Vlierzele or Merelbeke) are the most likely candidates for local outcrops that could have been used to produce these sherds (fig. 3).

Clay and sand from the Maldegem formation generally includes glauconite and mica. The Vlierzele member of the Gentbrugge formation also contains glauconite and mica. The member of Merelbeke is known to contain organic material and pyritic concretions (Van Lancker et al. 1993; Jacobs et al. 1999).

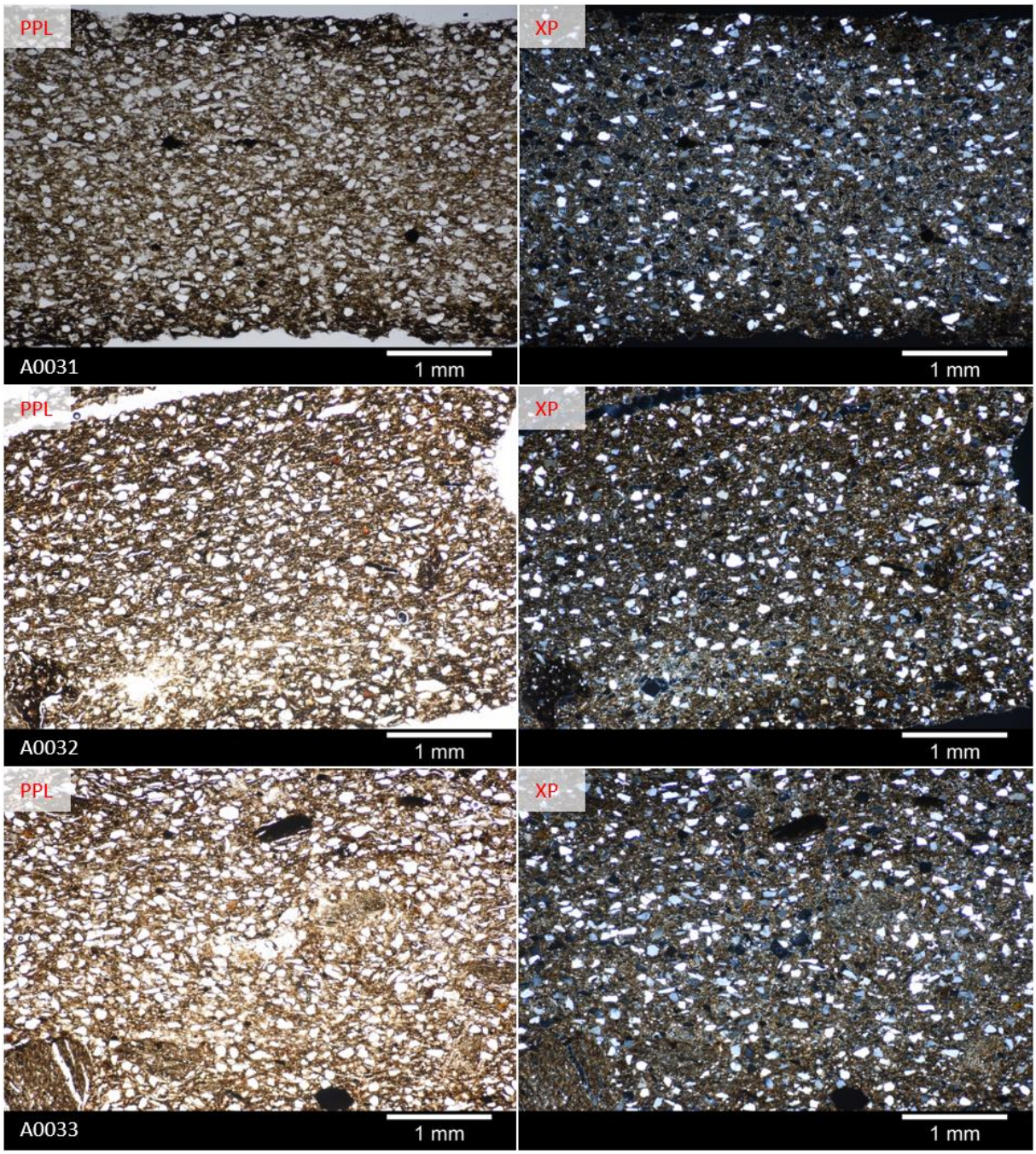

Fig. 1 Thin section micrographs from three samples demonstrating (moderately) well sorted quartz-rich fabrics. Visible at low magnification: quartz, glauconite, clay pellets and iron oxides.

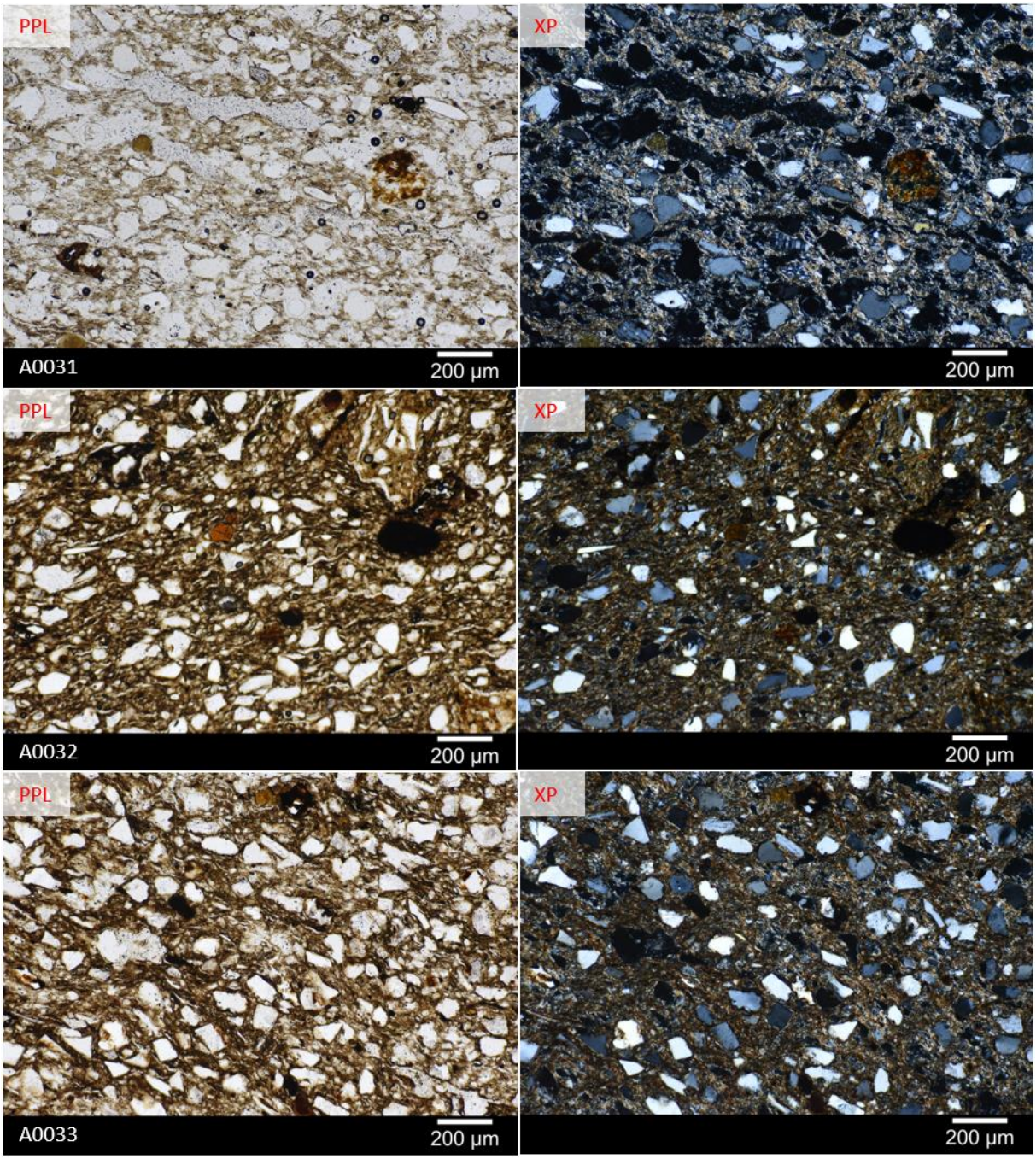

Fig. 2 Thin section micrographs from three samples at medium magnification demonstrating the presence of quartz, plagioclase feldspars, muscovite mica, glauconite and iron oxides.

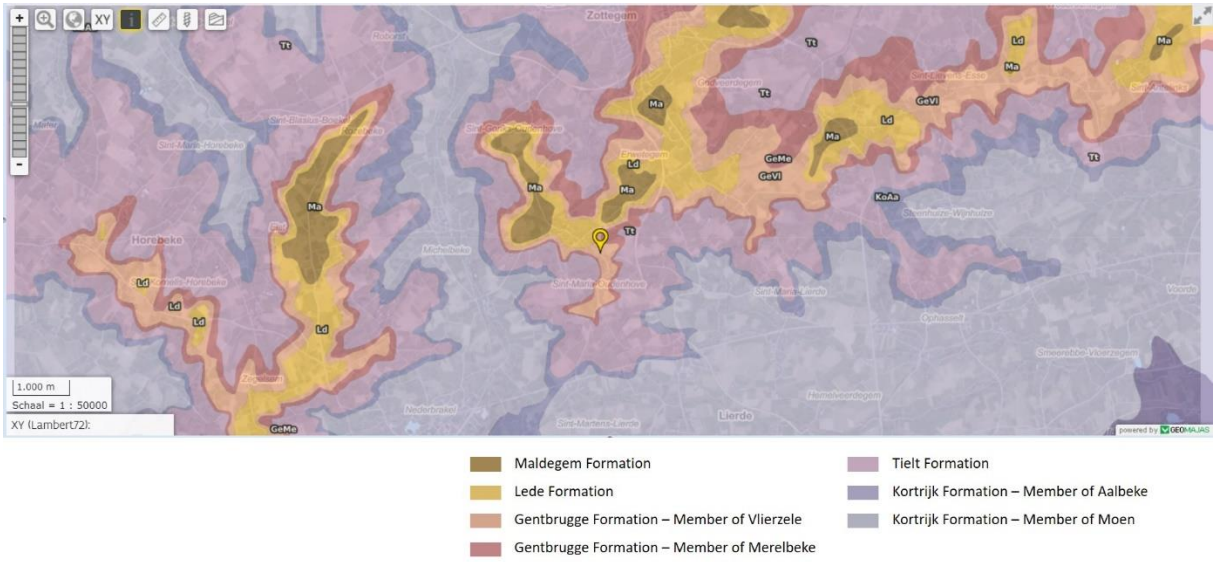

Fig. 3 Tertiary outcrops in the region surrounding the site of Sint-Maria-Oudenhove - Faliestraat. Site located at yellow marker. Detail extracted from the Flemish tertiary geological map (dov.vlaanderen.be).

COMPARITIVE ANALYSES

XRD and petrographic analyses of two pottery samples and one clay sample from the kiln (Goemaere & Goovaerts 2016). XRD results indicated a mineralogical content of ca. 50-70% quartz, ca. 8-9% feldspars, 15-40% clay. The clay is characterized as non-calcareous containing predominantly illite and some kaolin minerals. The signal is interpreted as matching the local Tertiary sedimentary geology.

The petrographic analysis of the two pottery samples (OLV-240 & OLV-285) determined that both samples belong to the same fabric and were made with a similar clay as the raw clay sample. The pottery samples are characterized as having a homogenous matrix (60-70%) with no optical activity, low porosity (1-2%), containing inclusions (25-40%) consisting of predominantly quartz, rare feldspars (K-feldspars, plagioclase and microcline), rare muscovite mica, sporadic glauconite, sporadic chert/flint, rare plastic inclusions/clay pellets, spots of iron oxides and a singular observation of organic matter identified as plant or charcoal. The samples are slightly bimodal with a population of very fine (40-100µm) well rounded detrital quartz grains and a second population of medium (200-500µm) angular to subrounded inequant detrital quartz grains.

The raw clay sample (OLV-388) is characterized with ca. 50-60% matrix and 25-35% inclusions. The clay is slightly bimodal with a population of very fine (40-100µm) well rounded detrital quartz grains and a second population of medium (200-500µm) angular to subrounded inequant detrital quartz grains. Observed minerals include predominantly quartz, rare feldspars (K-feldspars, plagioclase and microcline), very rare muscovite mica, rare glauconite, sporadic chert/flint and frequent iron oxides.

They concluded that the small differences between the two pottery samples are the result of incomplete mixture of the raw material. The mineralogical composition indicates the source material is a very fine sandy tertiary clay deriving from sedimentary rocks with a low degree of alternation of the clay and fine quartz sands. In this aspect, the pottery samples matches the raw clay and is very likely to have been the source material for the Roman pottery production.

The mineralogical composition of the three pottery samples (A0031 – SIFA015-286, A0032 – SIFA015-290, A0033 – SIFA015-290) match that of the two pottery samples (OLV-240 & OLV-285) analyzed by Goemaere and Goovaerts with only small variations. These five samples can be placed in the same fabric group. As a result, the three samples described here can also be attributed to the raw clay sample. Since this sample was recovered from the kiln, it cannot be stated for certain that it was also extracted at the same site. A comparison with local tertiary geological information indicates that this clay has likely been exploited from the surrounding landscape. Technologically, there is a distinction in optical activity, indicating the three samples (A0031-32-33) have been underfired, whereas the two samples (OLV-240 & OLV-285) have been overfired. No temper has been added. The sand fraction, semi-plastics and singular organic matter are accidental inclusions.

CONCLUSION

It can be concluded that the pottery recovered from the kiln and the pottery dump next to the kiln can be attributed to the same fabric group with only minor variations. The pottery is made from a sandy clay, worked to a semi-homogenous paste that left some natural occurring organic matter and large inclusions in the paste, and fired under reduced circumstance. The firing temperature was lower than 800°C, possible between 500-700°C, what could have resulted in underfired pottery. No temper has been observed. No evidence has been observed that the surface is covered with a real slip, but the darker color is rather the result of a worked surface or a change in atmospheric conditions in the kiln at the end of the firing process. The sandy clay is most likely selected from a local outcrop of tertiary sedimentary clay containing glauconite and muscovite mica. Possible candidates can be searched in the Formations of Maldegem and Gentbrugge. A previous analysis confirmed that clay recovered from the kiln matches the fabric from the pottery.

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WEBPAGE REFERENCES

Flepostore - https://www.flepostore.ugent.be/ceramics/5-re-be-0003

Databank Ondergrond Vlaanderen – https://dov.vlaanderen.be

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APPENDIX: PETROGRAPHIC DESCRIPTIONS

The following descriptions have been composed based on the methodology as described in Quinn 2013.

1.1 Thin section A0031 (SIFA015-SP161-INV286)

Semi-homogenous reduced-oxidized matrix with high optical activity and moderately porosity. Dominant quartz inclusions with frequent sedimentary rock inclusions and iron oxides, common muscovite mica flakes and glauconite, rare feldspars and amphibole/pyroxene. Iron-rich plastics throughout the sample. Overall moderately well sorted.

Matrix

Light brown fabric with dark brown edge; brown to dark brown in PPL and XP.
The matrix is semi-homogenous, non-calcareous, with a high optical activity.
- ca. 45-60%

Inclusions

Quartz (++; mono, poly, r-sr, silt-fine/medium sand), sedimentary rock detritus - possibly slightly metamorphosed - Q-arenite, chert, feldspars (-; plagioclase, microcline; r, cf), Fe oxides (+), amphibole/pyroxene (-; r, cf), muscovite mica flakes (+-; el, ff & cf), glauconite (brown in PPL), iron-rich plastics. Size of the coarse fraction varies from medium to very fine sand and for the fine fraction from fine sand to silt. The grains are generally sub-rounded to rounded. The fabric is moderately well sorted, single spaced and moderate well orientated.
- ca. 30-40%

Voids

Relative small planar voids, vughs somewhat larger, relative good alignment parallel to the edge, no infill.
- ca. 10-15%

Additional information

High optical activity indicates a relatively low firing temperature. Very close fabric to samples A0032 and A0033.

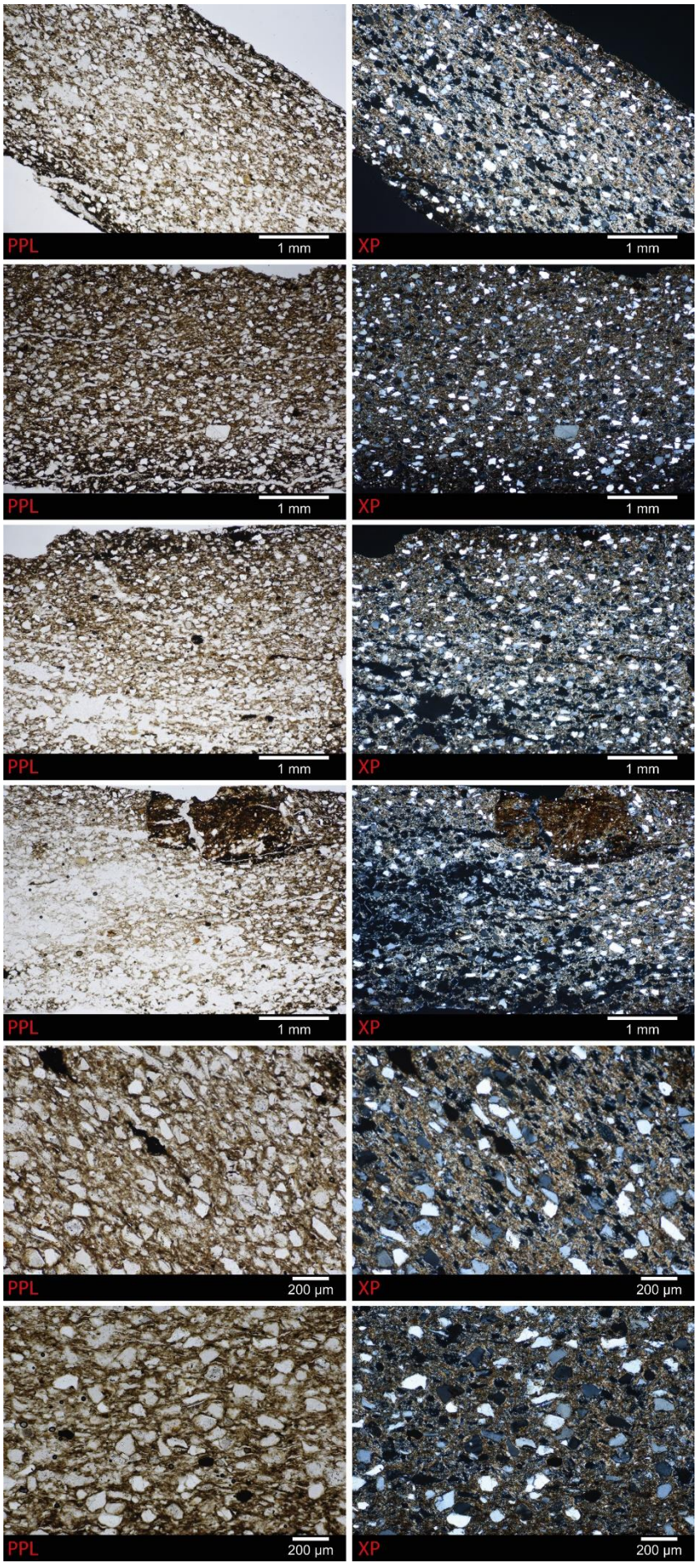

Fig. 4 Selection of thin section micrographs from sample A0031, SIFA015, SP161, INV286. Images on the left in plain polarized light (PPL), on the right in crossed polars (XP).

1.2 Thin section A0032 (SIFA015-SP287-INV290)

Semi-heterogeneous reduced-oxidized matrix with high optical activity and moderate porosity. Dominant quartz inclusions with frequent sedimentary rock inclusions, glauconite and opaques/iron oxides, common feldspars, muscovite mica flakes and clay pellets, few large organic inclusions. Overall moderately well sorted.

Matrix

Brown fabric with dark brown edge; brown to dark brown (PPL), dark brown (XP).
Semi-heterogeneous matrix, non-calcareous with high optical activity.
- ca. 45-60%

Inclusions

Quartz (++; mono, poly, r-sr, silt-fine/medium sand, some weathered or altered, intergrowth), sedimentary rock detritus - possibly slightly metamorphosed - Q-arenite, chert, feldspars (+-; plagioclase, microcline; r, cf), glauconite (+; red in PPL), O/Fe (+), organic matter (charcoal or burned plant), muscovite mica flakes (+-; el, ff & cf), clay pellets or semi-plastics (1. iron-rich and inclusion-poor, 2. iron-poor).
The coarse fraction ranges from medium to very fine sand, the fine fraction from fine sand to silt. Grains are generally sub-rounded to rounded. In general, the fabric is (moderately) well sorted, single spaced and (moderately) poor orientated.
- ca. 30-40%

Voids

Small to large planar voids and vughs, drying cracks around clay pellets, iron oxides and organic matter, moderately aligned parallel to edge, no infill.
- ca. 10-15%

Additional information

High optical activity indicates a relative low firing temperature. Same fabric as sample A0033 (same sherd?).

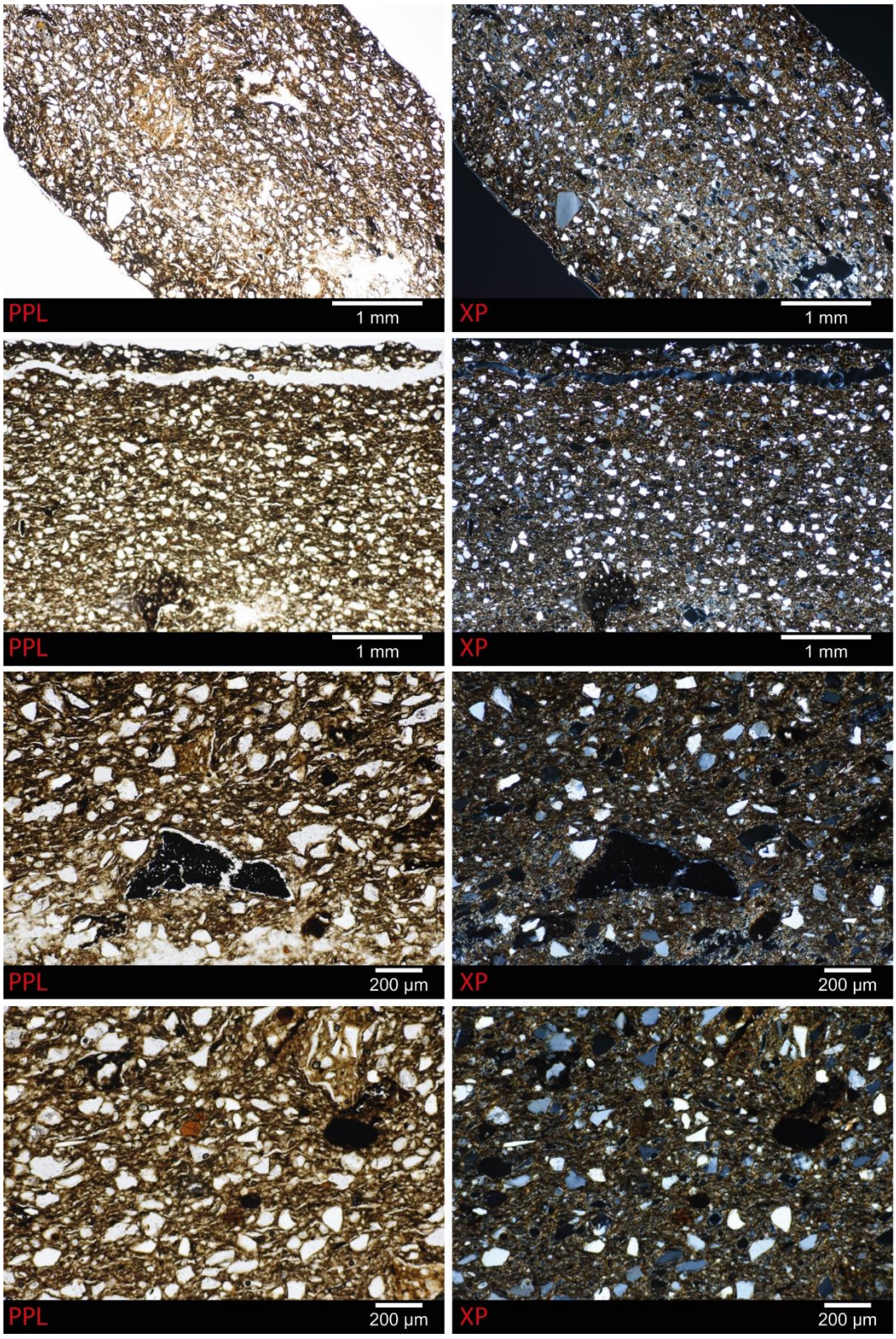

Fig. 5 Selection of thin section micrographs from sample A0032, SIFA015, SP287, INV290. Images on the left in plain polarized light (PPL), on the right in crossed polars (XP).

1.3 Thin section A0033 (SIFA015-SP287-INV290)

Semi-heterogeneous reduced-oxidized matrix with high optical activity and moderate porosity. Dominant quartz inclusions with frequent sedimentary rock inclusions, glauconite, opaques/iron oxides and semi-plastics, common feldspars and muscovite mica flakes. Overall moderately well sorted.

Matrix

Brown fabric with dark brown edge; brown to dark brown (PPL), dark brown (XP).
Semi-heterogeneous matrix, non-calcareous with high optical activity.
- ca. 55-65%

Inclusions

Quartz (++; mono, poly, r-sr, silt-fine/medium sand, some weathered or altered, intergrowth), sedimentary rock detritus - possibly slightly metamorphosed - Q-arenite/sandstone/siltstone, chert, feldspars (+-; plagioclase, orthoclase, microcline; sr, cf), glauconite (+; red in PPL), O/Fe (+), muscovite mica flakes (+-; el, ff & cf), semi-plastics (+; different composition from matrix: 1. iron-rich inclusion-poor and 2. fine-grained with higher optical activity).
The coarse fraction varies from medium to very fine sand, the fine fraction from fine sand to silt. Grains are generally sub-rounded to rounded. Overall, the fabric is moderately well sorted, single/double spaced and poor orientated.
- ca. 20-30%

Voids

Small to large planar voids and vughs, drying cracks in and around semi-plastics, moderately aligned parallel to edge, no infill
- ca. 10-15%

Additional information

High optical activity indicates a relative low firing temperature. Semi-plastics and clay pellets are the result of a section of fabric that is less successfully mixed. Same fabric as sample A0032 (same sherd?).

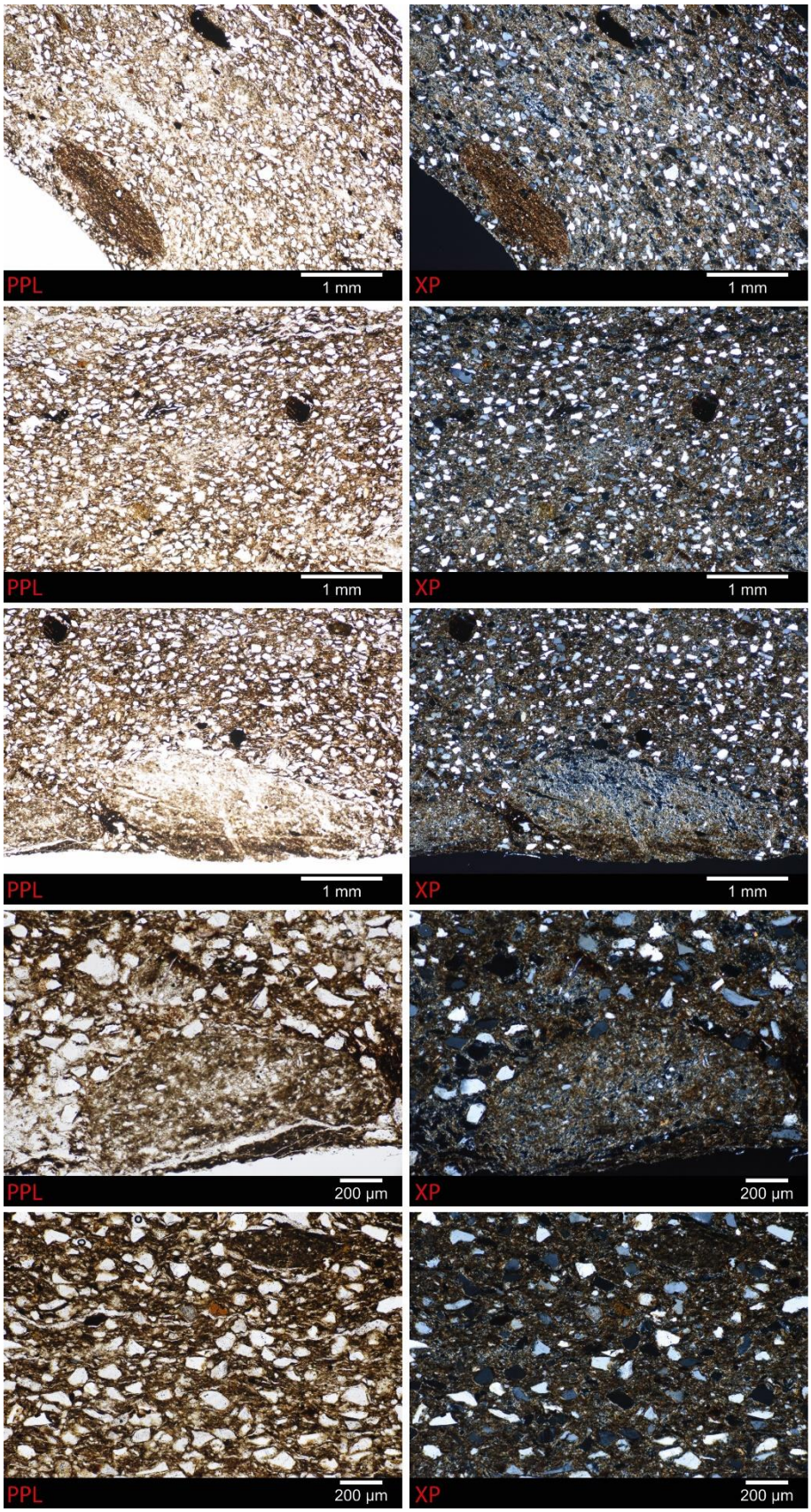

Fig. 6 Selection of thin section micrographs from sample A0033, SIFA015, SP287, INV290. Images on the left in plain polarized light (PPL), on the right in crossed polars (XP).