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THE MULTIPLICITY OF ASWAN PINK CLAY POTTERY (ROMAN TIMES TO LATE ANTIQUITY)

Synchronising shape repertoire, clay pastes and firing properties

Introduction

The so-called Pink Clay is one of the major clay resources in ancient Egypt and had been just studied recently for the first time in a comprehensive way, integrating archaeological and natural-scientific methods[1]. Regarding ceramic approaches to the material culture of Egypt, Nile mud and Marl clay pottery was in constant focus of studies dealing with the Pharaonic periods in Upper and Lower Egypt[2]. These clays, native to the geological landscape, have been extensively exploited as well in the post-Pharaonic periods, also reported in Aswan at the southernmost edge of the Roman Empire. The detailed analysis of ceramics originating from domestic contexts in ancient Syene[3] and on the nearby island of Elephantine[4], located in the urban area of modern Aswan, demonstrated the advent of yet another clay in pottery manufacture. The local "Pink Clay", easily recognizable in hand specimen fabric due to its usually buff pinkish firing colour, is first introduced in the Ptolemaic period, successively gaining importance during the Roman and Late Antique eras. By correlating the diverse clay compositions of Pink Clay and their associated physical properties to its firing behaviour, technological insights into the manufacturing process and technological choices will be acquired. It needs to be investigated in which way the firing procedure had to be executed in order to generate the diagnostic buff pink colour of the ceramics. Typo-chronological studies will provide data on the development of vessel shapes formed of this particular clay and detect how small-scale production of Aswan Pink Clay pottery expanded in the Late Antique period to a proper ceramic industry.

Compositional characterisation of the clay

"Pink Clay" is the term in literature used for a clay tentatively having been connected to kaolinitic sediments abundantly testified in the broader Aswan region[5]. It can be geologically related prominently to the weathering of pinkish feldspars constituting the local rose granite. A representative number of ceramic fragments that macroscopically had been identified as potential Pink Clay pottery has been evaluated in thin-section. Four clay pastes have been differentiated based on the character of aplastic particles embedded in the clay matrices. One clay paste, petrofabric ASW-PC_04 (**fig. 1d**), gives best evidence for a relatively pure kaolinitic sediment. It is a very fine-grained, potentially levigated petrofabric showing a typical greyish-beige colour under crossed polarising light. There are only a few discrete particles of reddish shale embedded in the kaolinitic clay matrix. The petrographic fabric group comprising the bulk of analysed samples had been named "typical Pink Clay" (ASW-PC_01, **fig. 1a**) as it consists of the spectrum of mineral and rock inclusions already described by Tomber and Williams who first examined a shard of Pink Clay pottery in thin-section[6]. It can be defined as a medium-coarse fabric with quartz, shale appearing in reddish-brown colour, alkalifeldspar, rarely plagioclase, chert, serpentinite and volcanic rock fragments of basaltic composition. A distinctive feature of this petrofabric, supporting its relationship to kaolinitic clay deposits, is the presence of clay pellets which exhibit matching properties to the clay noticed in petrofabric ASW-PC_04. The clay matrix can be described as ferruginous and possibly to a certain extent as kaolinitic. The clay raw material seems to have been extracted at a location at which kaolinitic clay is deposited close to the banks of the Nile, resulting in the natural combining of both sediments. A distinctive subtype of Pink Clay is petrofabric ASW-PC_02 (**fig.**

[1] The analysis of Pink Clay is part of the FWF-project P23866-G 18 "Housing in Antiquity (Late Ptolemaic, Roman and Late Antique Period) in Syene and Elephantine, Upper Egypt" directed by S. Ladstätter, Austrian Archaeological Institute, in cooperation with the Swiss Institute of Architectural and Archaeological Research in Ancient Egypt, Cairo.

[2] D. Arnold/J. Bourriau, An introduction to ancient Egyptian pottery. DAI Kairo Sonderschr. 17 (Mainz 1993) 166–182. – Compositional analyses of Egyptian ceramics focused also on the characterisation of marl clay and Nile sediments, most prominently having been discussed by J. D. Bourriau/L. M. V. Smith/P. T. Nicholson, New Kingdom Pottery Fabrics. Nile clay and mixed Nile/Marl clay fabrics from Memphis and Amarna (London 2000).

[3] The ceramic finds from Syene originate from a rescue excavation of Area 13c which were conducted by the Swiss Institute in cooperation with the Supreme Council of Antiquities, Aswan. See: C. v. Pilgrim et al., The Town of Syene. Mitt. DAI Kairo 62, 2006, 264–270; L. Rembart, Roman influence on pottery from the ancient town Syene (Upper Egypt). RCRF Acta 43, 2014, 617–622.

[4] Gempeler 1992; Rodziewicz 1992; M. Rodziewicz (Hrsg.), Elephantine 27. Early Roman industries on Elephantine. Arch. Veröff. DAI Kairo 107 (Mainz 2005); T. Ulbert, Keramikstempel aus Elephantine. Mitt. DAI Kairo 27, 1971, 235–242.

[5] P. Ballet/M. Vichy, Artisanat de la céramique dans l'Égypt hellénistique et romaine. Ateliers du Delta, d'Assouan et de Kharga. Cahiers Céramique Èqyptienne 3, 1992, 113–116; Gempeler 1992, 19; Rodziewicz 1992, 103 f.

[6] Tomber/Williams 1996, 382–387.

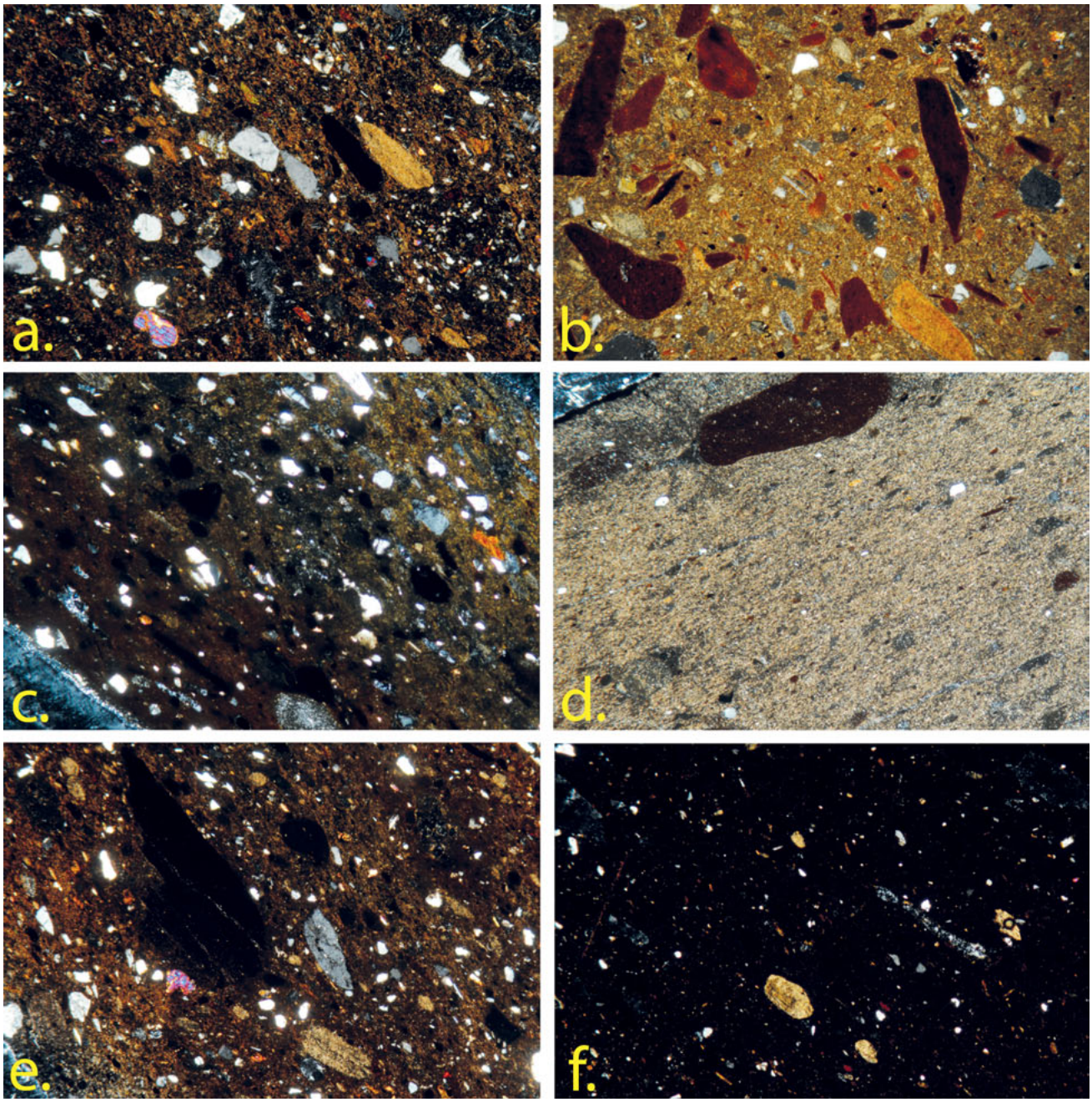

Fig. 1. Photomicrographs of thin-sections representing all identified Pink Clay pastes from Syene and Elephantine. **a** Petrofabric ASW-PC_01; **b** Petrofabric ASW-PC_02; **c** Petrofabric ASW-PC_03; **d** Petrofabric ASW-PC_04; **e** Petrofabric ASW-MIX_01; **f** Petrofabric ASW-MIX_02. – All images taken in crossed polarised light, ×50 magnification, image width = 4 mm.

1b), compositionally being coherent with the before-described clay, but being distinguishable by an increased shale-content, already visible with the naked eye. The addition of opaque isotropic particles, most likely identifiable as hematite or iron-ore fragments, is symptomatic for yet another Pink Clay variant, namely petrofabric ASW-PC_03 (**fig. 1c**). Additionally, two petrofabrics suggest an intentional mixing of Pink Clay with Nile mud and vice versa. In petrofabric ASW-MIX_01 (**fig. 1e**) small amounts of Nile mud sediments had been added to a kaolinitic base clay, while ASW-MIX_02 (**fig. 1f**) testifies the contrary with Nile mud dominating over a limited amount of Pink Clay.

Re-firing experiments and the creation of pink-coloured pottery

The colour a ceramic obtains when being finished, primarily depends on the nature of the clay, for instance firing buff yellowish when being calcareous or gaining a reddish colour when being rich in iron oxides. Raw clay of kaolinitic composition from Aswan is greyish when being mined. Achieving the creation of its characteristic pinkish colour in the firing process involves several factors. Besides the purity of the clay, the maximum firing temperature the clay had been exposed to is significant. Re-firing experiments

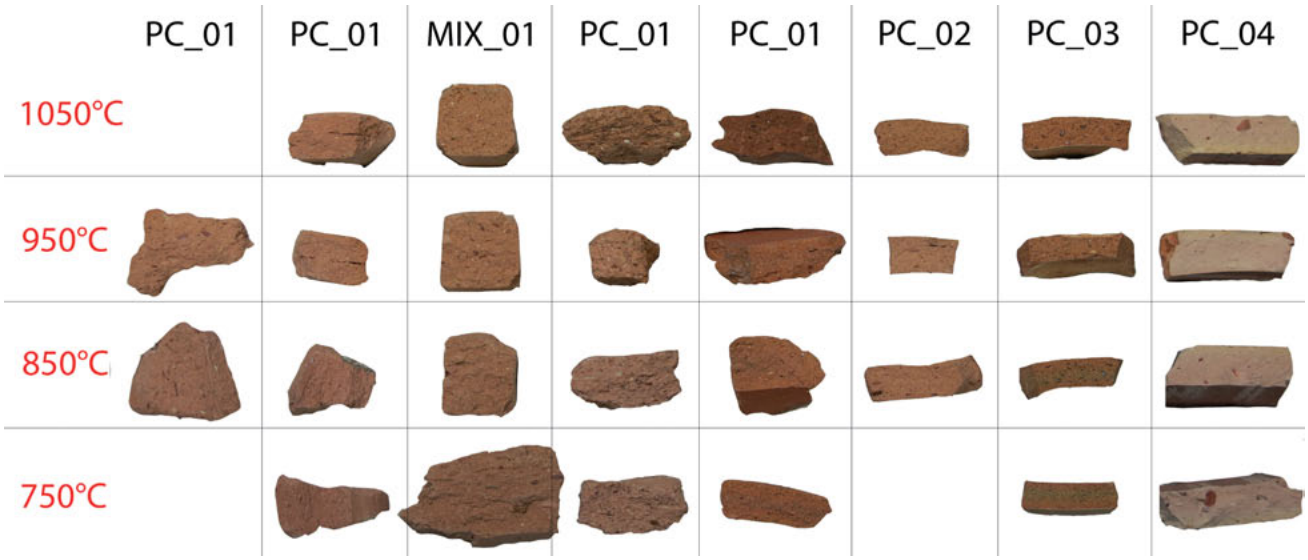

Fig. 2. Overview of the re-fired ceramic chips by composition.

were initiated in order to test for a correlation of these parameters. Eight Pink Clay shards covering all identified petrofabrics have been cut in individual chips. Accordingly, these were re-fired in a tube furnace at the French Institute of Oriental Archaeology in Cairo[7] at 750°C, 850°C, 950°C and 1050°C, respectively. The heating rate was 300°C per hour, with the specimens being fired subsequently for one hour at maximum temperature[8]. The experimental results are illustrated in **figure 2**. Comparing the visual varieties of "typical" Pink Clay (ASW-PC_01) alone reveals a certain heterogeneity in appearance. Pink, orange or brown tans are common for the macroscopic ceramic fabrics after re-firing, possibly being related to the varying iron-oxide content. Monitoring specifically for colour changes at different temperatures it is evident that the pinkish colour eponymous for this clay type is developed at temperatures around 850°C. When the temperature exceeds 850°C, the colour becomes orange or rarely exhibits a strong brown tan. For the sample representing the petrofabric rich in shale (ASW-PC_02) no visual changes between 850 and 950°C are obvious, but it turns to a brown colour at 1050°C. Regarding petrofabric ASW-PC_03 defined by opaque particles, the visible colour shift from greyish to an orange colour gained at 950°C is notable. Lastly, the purely kaolinitic petrofabric ASW-PC_04 turns from a gentle pale pinkish colour to yellowish above 950°C. Intentional mixtures of Nile mud and Pink Clay on the other hand fire to a characteristic orange colour compared to Pink Clay of a higher purity.

Having discovered certain tendencies and patterns in the visual appearance of Pink Clay pottery, the effects of the firing temperature on its composition and microstructure needed to be investigated. Thin-sections prepared of the re-fired chips showed some principal trends in regard to the clay's properties. At the same time with the visual change from pink to orange colour between 850°C and 950°C for the typical Pink Clay, the vitrification of the clay matrix usually is being initiated. In contrast, petrofabric ASW-PC_04 lacking any mineral grains and as such "impurities" even at 1050°C exhibits a moderately to slightly active clay matrix with no evidence of vitrification, typical for kaolinitic sediments. The latter observations support the excellent performance properties of kaolinitic clay at high temperatures and proves its assignation as a refractory, high-temperature firing clay.

Ceramic typology and technological choices

Based on the archaeometric data and the results of the recent research, the relationship between Roman and late Antique vessel typology and Pink Clay can be examined as follows. According to the completed statistical analysis only 49 % of the Roman vessels ware made of Pink Clay (petrofabrics ASW-PC_01 and _04) or mixed Pink Clay-petrofabrics (ASW-MIX_01 and _02), while 87% of the overall late Antique ceramic material is represented by Pink Clay (petrofabrics ASW-PC_01 to _03) or mixed Pink Clay-petrofabrics (ASW-MIX_01 and _02). Particularly noticeable within the pottery assemblage formed of this particular clay is the very high amount of tableware, constituting 45 % in Roman and 68 % in late Antique times.

Apart from a few fragments of imported wares and, as above mentioned, the 49% of vessels manufactured from Pink Clay and mixed Pink Clay petrofabrics, the remaining 45 % were made of Nile alluvium in the Roman period. However in late Antiquity tableware is exclusively composed of different Pink Clay recipes (**fig. 3**). Interestingly, vessels made of mixed Pink Clay-fabrics are predominating in early Roman Times. The common forms are bowls and plates of

[7] Many thanks to the staff associated to the Pôle d'archéométrie de l'Institut Français d'Archéologie Orientale – Laboratoire d'étude des matériaux.

[8] This experimental procedure is approved through several detailed re-firing studies on Mediterranean ceramics. Compare, for example, M. Daszkiewicz/G. Schneider, Klassifizierung von Keramik durch Nachbrennen von Scherben. Zeitschr. Schweizer. Arch. u. Kunstgesch. 58, 2001, 25–32.

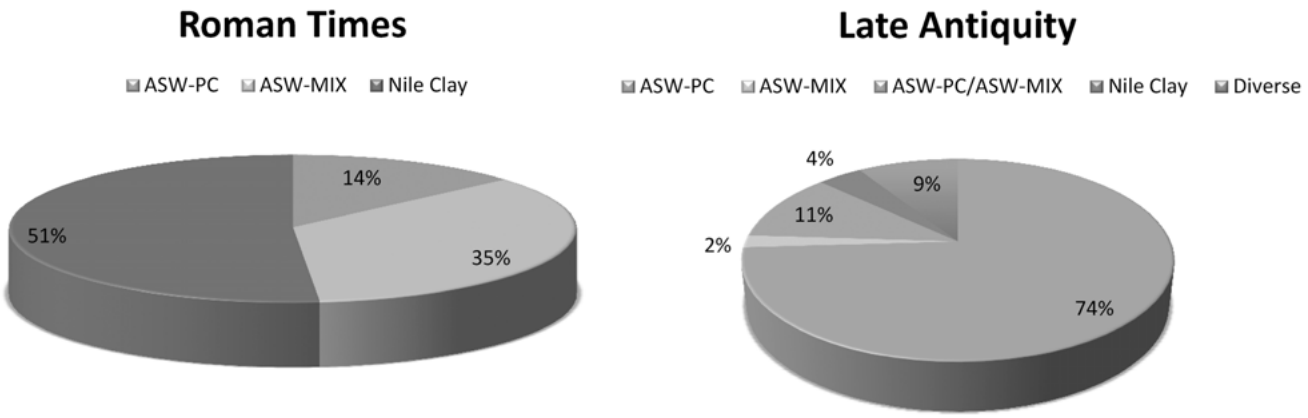

Fig. 3. Distribution of the fabrics.

Fig. 4. Small bowls with a white surface.

the so called Egyptian Red Slip Ware, which were influenced by vessels of the Mediterranean region. Especially Echinus bowls and carinated dishes, which were broadly similar to the Eastern Sigillata A form 4[9] were in use. It should be mentioned that the typical Pink Clay (ASW-PC_01) was mainly used for thin-walled bulbous bowls with a short everted rim, which appeared in early Roman times. In late Antique times 4 % of the tableware was produced by utilising ASW-PC_03, which is defined by iron-rich opaque inclusions. From a typological perspective, ASW-PC_03 is principally represented by small bowls with a white surface (**fig. 4**). Based on the chronological evaluation, this shape seems to have appeared for the first time in the 4th century AD and stopped in the middle of the 6th century AD. Surprisingly, no stylistic precursor for this shape has been identified on site. This is even more significant as usually, apart from this particular shape, the majority of the tableware shows close analogies to the Mediterranean vessel repertoire, like those of the African Red Slip Ware, the Late Roman C Ware and the Cypriot Red Slip Ware[10]. Due to its hard fabric, the white slip and the remarkable shape of this bowl, affinities to glass vessels might be assumed. The production of this indigenous Egyptian-style vessel shape from carefully selected but not extensively exploited clay seems to be a deliberate choice, attesting to a direct relationship between vessel type and clay paste in this case. In Roman times 19 %, and in late Antiquity 21 % of the overall ceramic assemblage can be assigned to domestic ware, characterised by its poor quality. While in Roman times the majority of domestic ware was made of Nile alluvium, more than two-thirds of the late Antique domestic vessels were manufactured using Pink Clay recipes. However, due to considerable internal variation within this archaeological group, a correlation between petrofabric and shape is severely hindered.

Similar to the tableware the majority of the Roman cooking wares were made of a mixed Pink Clay-fabric (**fig. 5**). Remarkable is the fact that this fabric was used mainly for cooking pots. The typical Pink Clay-fabric (ASW-PC_01), however, was used for the production of casseroles and

[9] J. W. Hayes, Sigillate orientali. In: G. Pugliese-Carratelli (ed.), Atlante delle Forme Ceramiche II. Ceramica Fine Romana nel Bacino Mediterraneo (Tardo Ellenismo e Primo Impero). EAA (Roma 1985) 15 f.

[10] Gempeler 1992, 41; J. W. Hayes, Late Roman pottery (London 1972) 387–388.

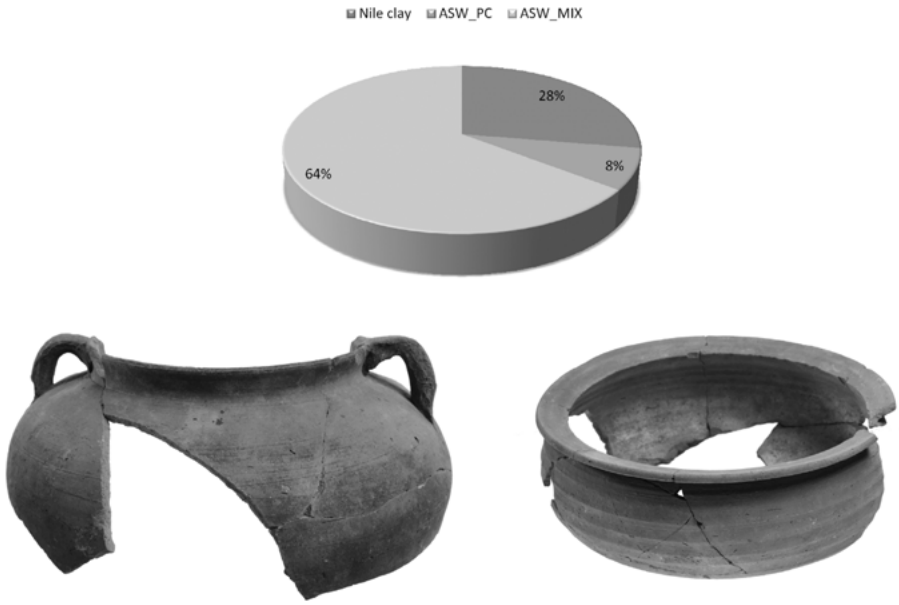

Fig. 5. Cooking Ware of Roman Times.

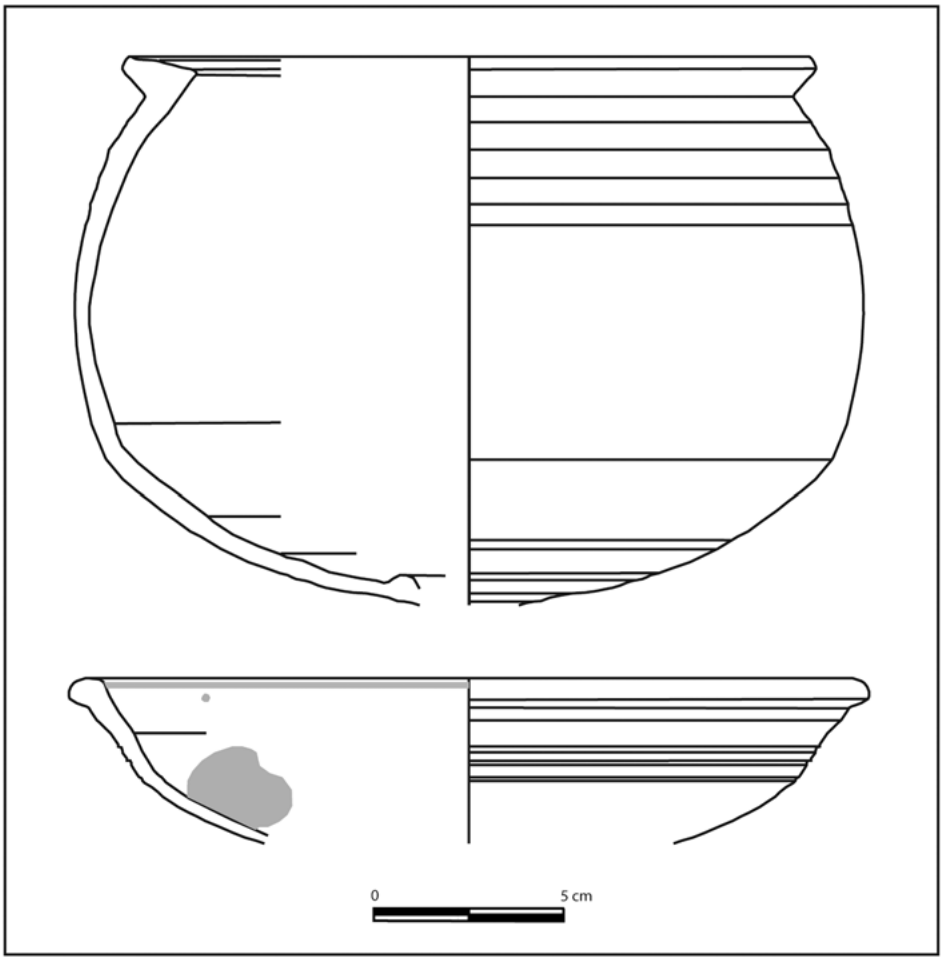

Fig. 6. Late Antique Cooking Ware.

cooking plates. Even though cooking wares have only been attested in the late antique housing complexes in small quantities, 28 % of these vessels are also attributed to Pink Clay respective to it being mixed with Nile sediments. The advantage of Pink Clay for functional purposes in the kitchen is without doubt related to its relative "refractory" character, as it is able to withstand repeated exposure to high temperatures, which facilitates the desired heat transfer. This is, for example, true of one special type of pot, dating from the 4th century AD to the second half of the 5th century AD (**fig. 6**). Later on, in the 7th century AD, Pink Clay was still being predominantly used in the production of casseroles that can reveal traces of paint on their interior. These case studies demonstrate the long tradition of using Pink Clay for cooking vessels as well. Another vessel type associated with Pink Clay petrofabrics is the transport amphora. Unfortunately, the state of preservation of the excavated shards is quite poor, with only the rim surviving, which does not always allow the amphora's complete shape to be reconstructed. In Roman times only 21 % of the amphoras were manufactured of Pink Clay, while 46 % of the late antique amphora fragments are made of this clay. The majority of these transport vessels was still produced with Nile alluvium.

Conclusion

The diachronic and interdisciplinary study showed that Pink Clay was used for manufacturing different kind of vessels since the late Ptolemaic – early Roman times. However in Roman times the Pink Clay had been intentionally mixed with Nile mud, while in late Antiquity vessels of pure Pink Clay are predominating. The four different clay pastes were mainly used for the production of tableware. However, the excellent properties of heat transfer had been detected very early and as such Pink Clay was used particularly for the production of casseroles and cooking plates. It can be stated that apart from the consumption of local pottery on site, Pink Clay pottery was a popular trade item, as indicated by its distribution all over Egypt. Additionally, this ceramic ware is widely spread in the Mediterranean area[11], but has also been attested in Nubia[12], to the South of Roman Egypt. All this evidence points to the importance of the region of Syene/Elephantine as a pottery production centre or better described as an expanding ceramic industry in Late Antiquity. Locally available clays were used for the production of pottery stylistically following Mediterranean prototypes.

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[11] D. M. Bailey, British Museum expedition to Middle Egypt. Excavations at el-Ashmunein 5. Pottery, Lamps and Glass of the Late Roman and Early Arab Periods (London 1998) 8; Tomber/Williams 1996, 382–387; J. W. Hayes, A supplement to late Roman pottery (London 1980) 531; P. Reynolds, Fine wares from Beirut contexts, c. 450 to the early 7th century. In: M. A. Cau/P. Reynolds/M. Bonifay, LRFW 1. Late Roman Fine Wares. Solving problems of Typology and Chronology, Roman and Late Antique Mediterranean Pottery 1 (Oxford 2011) 219; S. Bien, La vasaille et les amphores en usage à Marseille au VIIe s. et au début du VIIIe siécle: première ébauche de typologie évolutive. In: M. Bonifay/J.-Chr. Tréglia (eds.), LRCW 2. Late Roman Coarse Wares, Cooking Wares and Amphorae in the Mediterranean: Archaeology and Archaeometry 2. BAR Internat. Ser. 1662 (Oxford 2007) 264.

[12] W. Y. Adams, Ceramic industries of medieval Nubia. UNESCO archaeological survey of Sudanese Nubia: memoirs 1–2 (Lexington 1986) 525–560.

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