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DJILMA – AN IMPORTANT ARS PRODUCTION CENTRE IN CENTRAL TUNISIA. AN ASSESSMENT OF LATE ANTIQUE FORMS AND STAMPED DECORATION, FABRIC AND CHEMICAL ANALYSES BY WD-XRF

Djilma is one of the two most important production centres of African red slip ware vessel forms and lamps in central Tunisia. It produced African red slip ware (ARS) and lamps from the early 3rd century to the mid-5th century in a characteristic fabric (Atlante 1981: fabric E). Long-distance trade to the eastern and western Mediterranean distributed the standard vessel forms of ARS. They can be identified at the Athenian Agora as well. The range of late Antique forms and typical stamped decoration (Hayes style B) from a survey at Henchir el Guellal near Djilma in 1991 is decisively supplementing the preliminary results of the British-Tunisian survey carried out in 1984/85. Additionally, a specific reference group of chemical analyses by WD-XRF of ARS and lamps from Djilma carried out by G. Schneider (Berlin) and M. Daszkiewicz (Warszawa) is presented.

African red slip ware – production centre – Henchir el Guellal near Djilma – Athens-Agora – long distance trade – late Antiquity

Introduction

In his outstanding monograph on “Roman Pottery, Fine-Ware Imports” from the Athenian Agora, published in 2008, John Hayes described the state of research on African Red Slip Ware (Hayes 2008: 67-73). This had improved considerably since his handbook “Late Roman Pottery”, published in 1972, due to the international excavations and surveys, especially at Carthage, but also in other regions of Tunisia. There has also been a significant increase in our knowledge of the ARS production centres in northern Tunisia (El Mahrine, Oudhna) (Mackensen 1985: 29-39; Mackensen 1993; Barraud et al. 1998) and central Tunisia (Sidi Marzouk Tounsi, Henchir el Guellal near Djilma, Henchir es Srira etc.) (Peacock et al. 1990: 59-84; cf. Mackensen 1998a: 23-39; 1998b: 355-370) (fig. 1).

The fundamental work on fine ware imports from the Agora, especially the late Antique red ware classes, was carried out by Hayes in the 1960s. In his 2008 preface, he described his method of working - namely the treatment of individual fine ware classes - as “outmoded in its approach” (Hayes 2008: VII; cf. p. 292-305: deposit summaries with an overview of the closed deposits). In J. Humphrey’s Michigan excavation at Carthage in the mid-1970s, from the beginning the selected closed deposits played a decisive role for the chronology of the stratigraphy, although sufficient space was given to the type series of different pottery groups and in particular of later fine wares, cooking wares and coarse wares¹. As a member of Humphrey’s team, Hayes was also responsible for this methodologically important approach to Roman pottery in Tunisia.

¹ Cf. Hayes 1976: 49-73 (selected deposits), 74-123 (type series); Hayes 1978a: 113-117 (selected deposits); Hayes 1978b: 25-63 (selected deposits), 64-98 (type series)

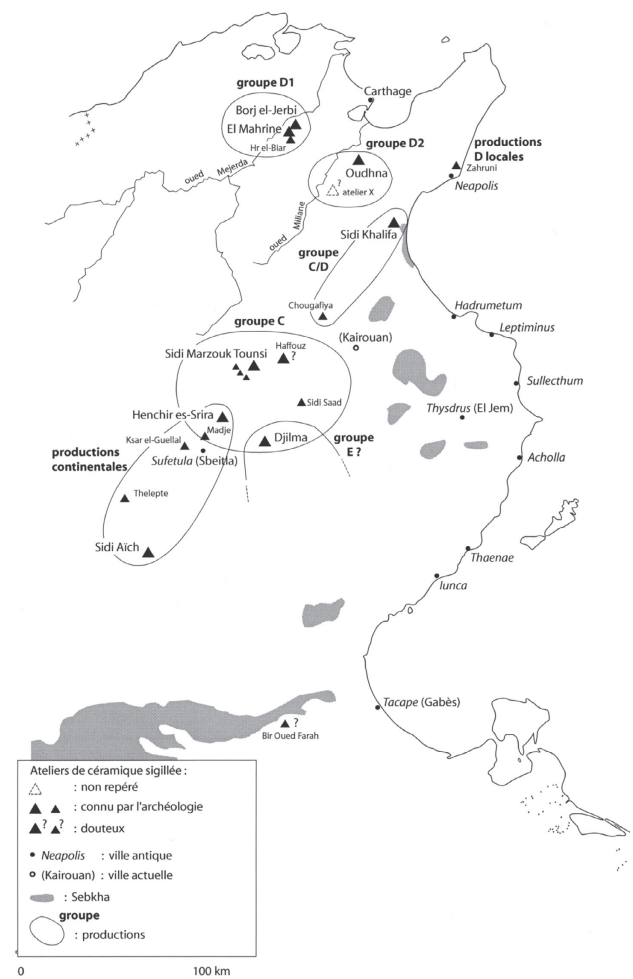


Fig. 1. Mid-Imperial and late Antique ARS potteries and production centres in Tunisia (Bonifay 2004: 46, fig. 22).

In the introduction to the African red slip ware from the Agora, Hayes updated his text several times. He referred to the differentiated classification of fabrics of the *terra sigillata africana* by A. Carandini, St. Tortorella and L. Sagui in the “*Atlante delle forme ceramiche I*” (Atlante 1981). He also drew attention to the range of vessel forms and stamp-types of individual production centres of fine wares in northern and central Tunisia such as El Mahrine (Mackensen 1993; cf. Ben Moussa 2007: 78-108) and Sidi Marzouk Tounsi (Peacock et al. 1990: 66-74, figs. 5-9; Mackensen 1998b: 355-370, figs. 1-9). The products from these fine ware centres had achieved widespread distribution in the eastern and western Mediterranean through long-distance trade. However, important advances made between 1990 and 1998 were not considered with regard to the huge amount of ARS from the Agora. Thus, a consistent differentiation of ARS by region of production or by individual production centre is missing, although this would actually have been possible, in particular for specialists such as Hayes. Only occasionally, but not systematically, are there references to individual production centres in the catalogue.

In the description of forms Hayes 62A and 68, Hayes referred to the “rather fine-grained but thickly potted fabric bearing a thin matte slip inside and outside” and the “distinctive maroon or brownish red tint” (Hayes 2008: 69). According to him, the fabric was consistent with category E (Cf. Atlante 1981: 119), introduced by the above-cited Italian archaeologists. The distribution in the “south-central coastal areas of Tunisia” seemed striking to him. Rather casually, Hayes already identified the production site of fabric E in 2008 as Henchir el Guellal, Djilma (Hayes 2008: 69, note 19), hereafter referred to only as Djilma. However, he did not make any explicit assignments with regard to other forms and the associated stamped decoration which was occasionally surrounded by a single or double band of rouletting, forming a “herringbone” wreath.

With regard to the Athenian Agora and other important consumer cities outside the provinces of *Africa Proconsularis* and *Byzacena*, such as Rome, Aquileia, Milan, Ravenna, Durres, Marseille, Tarragona, Cordoba, Corinth, Antioch and Alexandria, the identification of the products of important late Antique ARS production centres in north-eastern and central Tunisia² is of decisive importance for the evaluation of the late Antique pottery trade. Only in this way can the negotiation of the products on transport routes of the regional road system to the trading ports such as *Karthago*/Carthage, *Pupput*/Souk Abiod, *Horrea Caelia*/Hergla, *Hadrumentum*/Sousse, *Leptiminus*/Lamta and *Sullectum*/Ras Salakta in present-day northern and central Tunisia (Mackensen 2019: 67-71, fig. 28) (fig. 1) as well as further on via the sea-based long-distance trade be assessed in a more differentiated manner.

Pottery-specific forms, decoration and fabric

Consequently, a prerequisite for archaeologists working with excavated material is a profound knowledge of the

pottery-specific or at least region-specific range of forms and the corresponding standard shapes. This also applies to the late Antique stamp-types and the stamp styles A-E defined by Hayes (Hayes 1972: 217-281; Mackensen 1993: 186-288; Mackensen 2019: 158-179; Cardarelli 2022: 76-90, figs. 45-66) as well as to other types of decoration such as vertical gouging (superficial cuts in the exterior of wall), feather rouletting and bands of rouletting, appliqué and relief decoration. The pottery- or workshop-specific clay matrix can be determined macroscopically (20×) with or without characteristic impurities, mostly caused by tempering, such as quartz, feldspar and lime. However, the clay matrix was frequently subject to deteriorations in the tempering at the same production site with the passage of time. At best, the color of clay and slip are a further distinguishing feature. During ongoing excavations and surveys, it should be possible to check the clay matrix and the fabric of ARS sherds macroscopically. As decisions must be made *ad hoc* on site, the classification system of fabrics must be arranged for practical applicability and corresponding reliability (Mackensen 2022: 185). Hayes had offered very good descriptions of the various fabrics, but he did not classify them (Hayes 1972: 287-292). An appropriate and frequently accepted system of classification of fabrics for ARS (A¹⁻², A^{1/2}, A/D, C¹⁻⁵, D¹⁻², C/E and E), which was widely distributed in the Mediterranean, was offered by the above-cited Italian archaeologists in 1981 (Atlante 1981: 19-183).³

Thin sections with petrographic analysis and chemical analysis by wavelength-dispersive X-ray fluorescence (WD-XRF) are costly and can usually only be carried out on selected material, if at all, due to restrictions imposed by the host country. However, only in exceptional cases is it possible to use thin sections and/or chemical analysis. For both, reference material from the workshop should be available, preferably wasters or misfired fragments and potter's tools such as *pugilla*,⁴ stamps or clay moulds. In my opinion, different fabrics defined by the appearance of the thin sections, illustrated by microphotographs, of the same ARS workshop, which do not allow an assignment beyond doubt, are not very helpful. In general, much more reliable are chemical reference groups (and their mean values) from different pottery centres, as G. Schneider and I have already shown in 2002 and 2006 (Mackensen and Schneider 2002; Mackensen and Schneider 2006; Mackensen 2019: 34). The analyses were conducted on a series of samples, most of which came from north-eastern and central Tunisian ARS production centres such as El Mahrine, Henchir el Biar and Bordj el Djerbi, Oudhna and Sidi Marzouk Tounsi, Djilma and Henchir es Srira (fig. 1). The late Antique ARS production centre of the so-called D²-group (= *atelier X* [renamed by M. Bonifay]) (Bonifay 2004: 49-50, fig. 22) is not yet located, however it was assumed to be in the region of El Fahs, Zaghouan and Oudhna (Mackensen and Schneider 2002: 128, 139-140, 157 table 4).

² Cf. a recent overview of the important ARS production centres: Mackensen 2019: 35-77.

³ Cf. Bonifay 2004, 45-53; Bonifay 2016: 519-528; recently Mackensen 2019: 31, 33.

⁴ Cf. Mackensen 1993: 28-32 fig. 3,3-7 (Oudhna), 74-83 figs. 18-22 (*pugilla* from different ARS production sites in Tunisia); Bonifay 2004: 59-60, fig. 29; Mackensen 2009: 21-28, figs. 2-4, table 1.

The same applies to the mid Imperial potteries of the A¹/A² group, probably from north-eastern Tunisia (Mackensen and Schneider 2006: 170-173 table 1, 180-181 fig. 9) and the A/D group (Sabratha) which originates from Tripolitania and not from north-eastern Tunisia (Mackensen and Schneider 2006: 173-174 table 2, 182-183 fig. 10).⁵ Especially the chemical analysis of single sherds and the composition of major and trace elements allows a clear assignment to specific reference groups of one of the large production centres. The different pottery-specific distribution of elements such as titanium and potassium or iron and magnesium was demonstrated in conclusive diagrams (Mackensen and Schneider 2006: 172, figs. 6-7) (see below with **fig. 6,1.2**). Additionally there is a reference group by WD-XRF analysis for the late Antique production centre of *Pheradi Maius*/Sidi Khalifa (Brun 2007; Heimerl 2016: 490-492, fig. 2,1-12 table 1; Ben Moussa 2007: 109-217);⁶ the ARS fabric was normally classified as D², however Bonifay suggested a new designation C/D (Bonifay 2004: 49; Bonifay 2016: 525). A series of chemical analyses of *pugilla* with graffiti (Mackensen 2009: 21-28, figs. 2-4, table 1,1-6) and a huge series of WD-XRF analyses of stamp-, applique- or relief-decorated ARS of fabrics C¹⁻⁵ was recently published (Mackensen 2019: 358-359, table 1 - G. Schneider/M. Daszkiewicz). For ARS production centres of only regional importance such as Thelepte and Sidi Aïch (the so-called *productions continentales* according to Bonifay) (Bonifay 2004: 46, fig. 22) (**fig. 1**) and Henchir en Nadhour/Majoura (Nasr 2015: 115-143; Nasr: 2021, 1-28), chemical analyses by WD-XRF are still missing.

The production centre of Henchir el Guellal near Djilma and the equivalent ARS at Athens

In the following, I concentrate on the late Antique ARS range of forms and in particular on the stamped decoration from Djilma in order to identify corresponding stamp-decorated material among the ARS from the Agora. In June 2016, I had the possibility to study the stamp-decorated ARS in the American School of Classical Studies at Athens.⁷

The production of ARS and lamps at Djilma was discovered during the 1984/85 British-Tunisian survey in central Tunisia, which was initiated by D. P. S. Peacock. The site is only about four hectares in size, pottery wasters were found on extensive rubbish heaps next to the presumed individual workshops of the ARS production site. D. P. S. Peacock, F. Bejaoui and N. Ben Lazreg published a preliminary report concerning a predominantly late Antique ARS range of forms and some ARS lamp fragments from Djilma (Peacock et al. 1990: 76-79, figs. 13-14). In addition, there was some protec-

tive cylindrical kiln furniture (so-called saggars or *cassettes de cuisson*) marked on the horizontal rim with graffiti in italics or stamped with late Antique palm-branches, concentric circles and birds (Peacock et al. 1990, 79; 81 fig. 14a-n). The cylindrical saggars are known as a safeguard used in kilns of many north African fine ware production centres to protect ARS and lamps during the firing process (Mackensen 1993: 88-94 fig. 24,1-7, 291-293 fig. 101,5; Bonifay 2004: 60-65 figs. 30-31).⁸ They are a reliable and definite proof for a production site. It was assumed that the period of production lasted from the early 4th century to the mid-5th century (Peacock et al. 1990: 79). However, based on the presence of the A/D-form Hayes 32 and of the C^{1/2}-forms Hayes 44, 45B and 50A, I have argued for a start of production already around the middle of the 3rd century (Mackensen 1993: 37) and subsequently for an earlier start around 230/250 or even in the first quarter of the 3rd century (Mackensen and Schneider 2002: 155; Mackensen 2019: 54). A final publication, especially of the plain, stamp-decorated and relief-decorated ARS and the lamps, is still lacking. This applies in the same way to all the other ARS potteries discovered during this survey, including the most important ARS production centre Sidi Marzouk Tounsi (Peacock et al. 1990: 66-74, figs. 5-9).

Ph. M. Pröttel visited the pottery area of Djilma in 1991 and carried out a short survey. He reported briefly (without illustrations) on the A/D-, C¹- and C²-forms of the 3rd century as well as on the C^{3/4}-forms and stamped decoration of style B (after Hayes) of the 4th and the first half of the 5th century (Pröttel 1996: 20-21 with note 47). Besides a series of discolored and misfired fragments of plates and bowls (wasters) there are two stamp-decorated fragments of saggars (**fig. 2, 1.2**). It seems sensible to present this survey material with the permission of Pröttel now,⁹ for 35 years after the British-Tunisian survey there is no hope for a final publication of one or the other ARS pottery.

During an investigation of the various ARS groups of the 3rd century, I have already sampled a series of A/D- and C^{1/2}-forms of the 3rd century from various sites including some of the mid Imperial ARS sherds from the British-Tunisian survey. G. Schneider has chemically analyzed them by WD-XRF. One of the results was a first pottery-specific reference group for Djilma (Mackensen and Schneider 2006: 177-178, table 4; 185-186 fig. 12,1-12),¹⁰ characterized by high levels of the major elements magnesium (MgO) and potassium (K₂O) - in contrast to the characteristic high levels of titanium (TiO₂) and iron (Fe₂O₃) for Sidi Marzouk Tounsi (Mackensen and Schneider 2006: 175-176, table 3). The fabric of these mid Imperial C^{1/2}-forms corresponds to the fabric C/E classified by the Italian archaeologists (Atlante 1981: 117-118).

⁵ Cf. recently for two mid-Imperial A/D groups, the so-called Sabratha group and a new so-called Tripolitanian group (S. Schmid and M. Weber in Mackensen 2021: 159-162, table 5); the unlocated production centres can be postulated according to their limited distribution in Tripolitania

⁶ For a critical summary of the state of research recently Mackensen 2019: 63.

⁷ I would like to thank very much J. McK. Camp and Mrs. S. Dumont for giving me access to the ARS from the Agora and for providing me with various photographs by C. Mauzy (**fig. 7,1-6**).

⁸ See with new evidence from El Mahrine and Bordj el Djerbi as well as different methods of piling the ARS vessels (even of various forms) in these cylindrical saggars: Mackensen 2009, 28-36 figs. 6,3,4; 7,1; 8-10.

⁹ We would like to thank the colleagues of the *Institut Nationale du Patrimoine* (Tunis) for their encouragement and support.

¹⁰ However, the fabric was still classified as A/D (form Hayes 27, 31 and 32), C¹ and C² (forms Hayes 44, 45A-C, 48A and 50A) instead of fabric A/D and C/E, characteristic for Djilma. Finally corrected by Mackensen 2019: 54-55 suggesting a classification of the specific Djilma fabric as A/D/E which would be appropriate to fabric C/E; cf. Atlante 1981: 117-118.

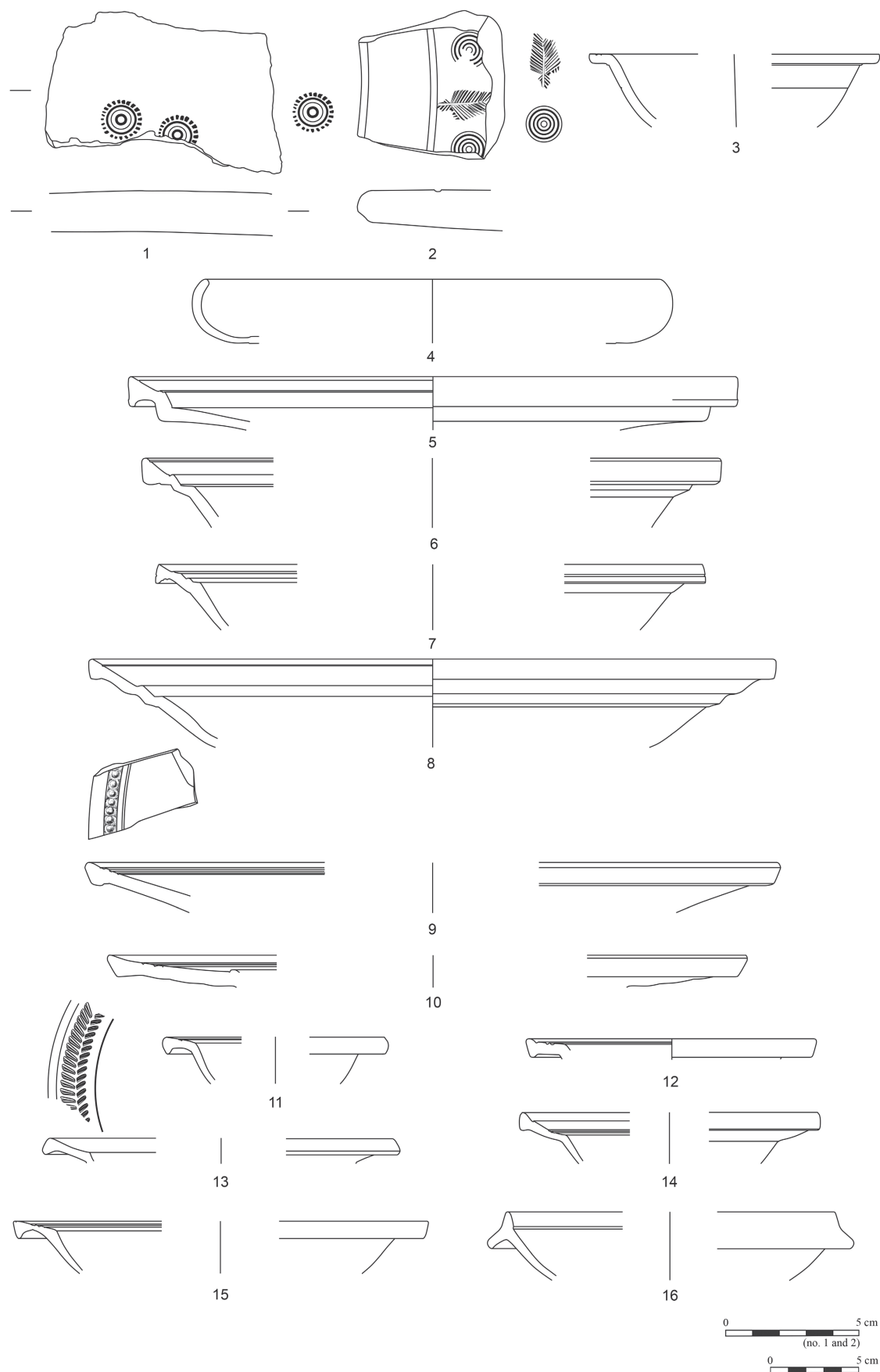


Fig. 2. Henchir el Guellal near Djilma. 1-2 Stamp-decorated saggars; 3-16 late Antique ARS forms (3 sample no. 152; 4 sample no. 156; 5 sample no. 155; 10 sample no. 385; 11 sample no. 388; 14 sample no. 384; 16 sample no. 386; see sample nos. in Table 1).

Regarding the late Antique ARS forms from Djilma, Peacock had already presented flat-based dishes Hayes 58A, 60, 62A, large plates Hayes 66, large bowls Hayes 68 and 75, small bowls Hayes 70 and a flanged bowl Hayes 92 (Peacock et al. 1990: 80, fig. 13). However, he published only two stamp-decorated fragments of unclassified dishes (Peacock et al. 1990: 79, fig. 14o.p.). The range of forms, which is obviously limited to a few standard shapes, can be slightly extended: there are not only the characteristic central Tunisian plates Hayes 62A (fig. 2, 4), 66 (fig. 2, 5) and large bowls Hayes 68 (fig. 2, 6-8) as well as fairly rare, large plates Hayes 77 with and without dot decoration on the rim (fig. 2, 9-10). In addition, small bowls Hayes 70 and 70 Var. with a double rouletted band on the rim (fig. 2, 11-13, 15) belong to the range of standard shapes as well as the small bowl Hayes 72 (fig. 2, 14) and the flanged bowl Hayes 92 (fig. 2, 16). The undersides of the slipped plates such as Hayes 62A and 68 show so-called twig-marks (fig. 4, 2), grass or straw-impressions, already noticed by Hayes (Hayes 1972: 289). The late Antique production period of Djilma¹¹ can be dated according to the represented ARS forms from the early 4th century to the mid-5th century (Hayes 1972: 109, 117) and the stamp-decorated forms from c. 350 to c. 425 or slightly later (Hayes 1972: 220).

The plates and dishes Hayes 82-84 (mid and 2nd half of the 5th century) with the characteristic fine feather rouletting covering most of the wall and stamped decoration of style D and the small bowls Hayes 85, corresponding to forms Hayes 82-84, were not manufactured in the workshops at Djilma. These high-quality vessels, in respect of the stamped decoration and the feather-rouletting, were produced only in the workshops at Sidi Marzouk Tounsi in fabric C⁵ (Peacock et al. 1990: 71, fig. 7, 15, 16; Mackensen 1998b: 357, fig. 2, 1-5; Mackensen and Schneider 2002: 133 fig. 6, 1-9).

What is decisive for the identification of late Antique ARS produced in Djilma is the corresponding stamped decoration of Hayes style B (Pröttel 1996: 20; for style B see Hayes 1972: 219-220) on forms Hayes 62A (fig. 2, 4) and 68 (fig. 2, 6-8), a selection of which is published here (fig. 3, 1-16 and fig. 4, 1).¹² The slender, triangular palm-branches of types Hayes 9 (fig. 3, 19), 10 (fig. 3, 20-24) and 10 Var. (fig. 3, 25-26) (Hayes 1972: 231-233, fig. 39c-i) with all ribs turned upwards and with two or three short vertical ribs or two dots on each side at the bottom show a characteristic finely executed feature. The stem of the palm-branch shows a so-called herringbone pattern with the ribs turned downwards (Hayes 1972: 231). Without doubt they are the hallmark of style B. Additionally there is also an ovoid palm-branch with ribs turned upwards without a short stalk (Hayes 1972: 220), which might be classified as type Hayes 3 Var. (fig. 3, 17-18) (Hayes 1972: 229, fig. 38f). Hayes regarded this palm-branch as copying palm-branches of style A and being presumably earlier than his types 9 and 10 (Hayes 1972: 220).

Most of these palm-branches are arranged radially around the centre or around one to three concentric grooves (fig. 3, 1-6). They are combined with an alternating ornamental motif such as three to five concentric circles of type Hayes 26-28 (fig. 3, 27-30) or nine-petalled rosettes (fig. 3, 32-33) or an additional outer decorative band with only one repeated ornamental motif, in this case mostly concentric circles. In another decoration pattern the decoration moves outwards, leaving a plain centre (fig. 3, 12) surrounded by two or three grooves; the outer band flanked by one or two grooves shows mostly two floral or ornamental motifs alternating or just a single repeated motif (fig. 3, 12-16). Only one heavily fragmented zoomorphic stamp was mentioned by Pröttel,¹³ in an outer band of decoration (fig. 3, 4 and 35). However, a not very detailed, stylized bird to the right was already listed by Hayes as stamp-type 180 of style B from the Athenian Agora (Hayes 1972: 257 fig. 47c = Cardarelli 2022: 316 Av.3.7; 506 pl. 68,16). In the meantime, it has been fully published and seems to be identical (Hayes 2008: 234 pl. 58,1194). Sometimes the stamped decoration is surrounded by a single or a double rouletted band (fig. 3, 9 and 13-14). Pröttel already suggested a classification of the different possibilities to arrange the stamp-types, which results in style B (I) to B (III) (Pröttel 1996: 20; Cardarelli 2022: 82-83, fig. 58,1-3), however there are additional varieties concerning the outer band of stamped decoration or an outer rouletted or herringbone band.

The known range of forms and stamps of style B (according to Hayes) is neither very extensive nor particularly variable. The late Antique forms Hayes 58A (fig. 2, 3), 60 no. 3, 62A (fig. 2, 4), 66 (fig. 2, 5), 68 (fig. 2, 6-8), 75, 77 and 77 Var. (fig. 2, 9-10) as well as 70 (fig. 2, 11 and 15), 70 Var. (fig. 2, 12-13), 72 (fig. 2, 14) and 92 (fig. 2, 16) must be regarded as characteristic central Tunisian forms. Some of them can also be found in Sidi Marzouk Tounsi (Peacock et al. 1990: 71, fig. 7). However, the stamped decoration with the stamp-types Hayes 9, 10 and 10 Var. of style B, which seems to be limited to plates and dishes of the forms Hayes 62A and 68, is obviously pottery-specific, that means the stamped decoration is a characteristic anepigraphic signature of the Djilma workshops.

On the other hand, the characteristic dart-shaped triangular palm-branches of type Hayes 12-14 of style C (Hayes 1972: 220; 233, fig. 39k-o) do not occur in Djilma. Only recently, V. Cardarelli provided evidence of two of these stamp-types from Henchir es Srira (Cardarelli 2022: 48-49, fig. 26,3.4; 63). The neat and nicely executed stamps of style D (after Hayes) (Hayes 1972: 220 f) and in particular the early Christian motifs of the main and late phases of Style D such as Chi-Rho motifs, cross-monograms or plain crosses, which I have recently compiled, documented and attributed to Sidi Marzouk Tounsi (Mackensen 2019: 41-53, figs. 17-18; 158-179, figs. 75-85), are not known from Djilma. Furthermore, because of chronological reasons no stamps of human figures are known from Djilma.

¹¹ For the lamp production see recently Mackensen 2020, esp. 104-112, figs. 5-6; for corresponding chemical analyses (WD-XRF and portable WD-XRF) see Daszkiewicz et al. 2020: 87-93, table 1.

¹² See already Mackensen 2019: 55, fig. 19,1-7; cf. typical products of Djilma: Mackensen 2019: 297-299, cat. 97 (Hayes 62A) and 102 (Hayes 68) pls. 53, 97; 55, 102; 169, 97; 171, 102.

¹³ Pröttel 1996: 20, who did not know any identical stamps.

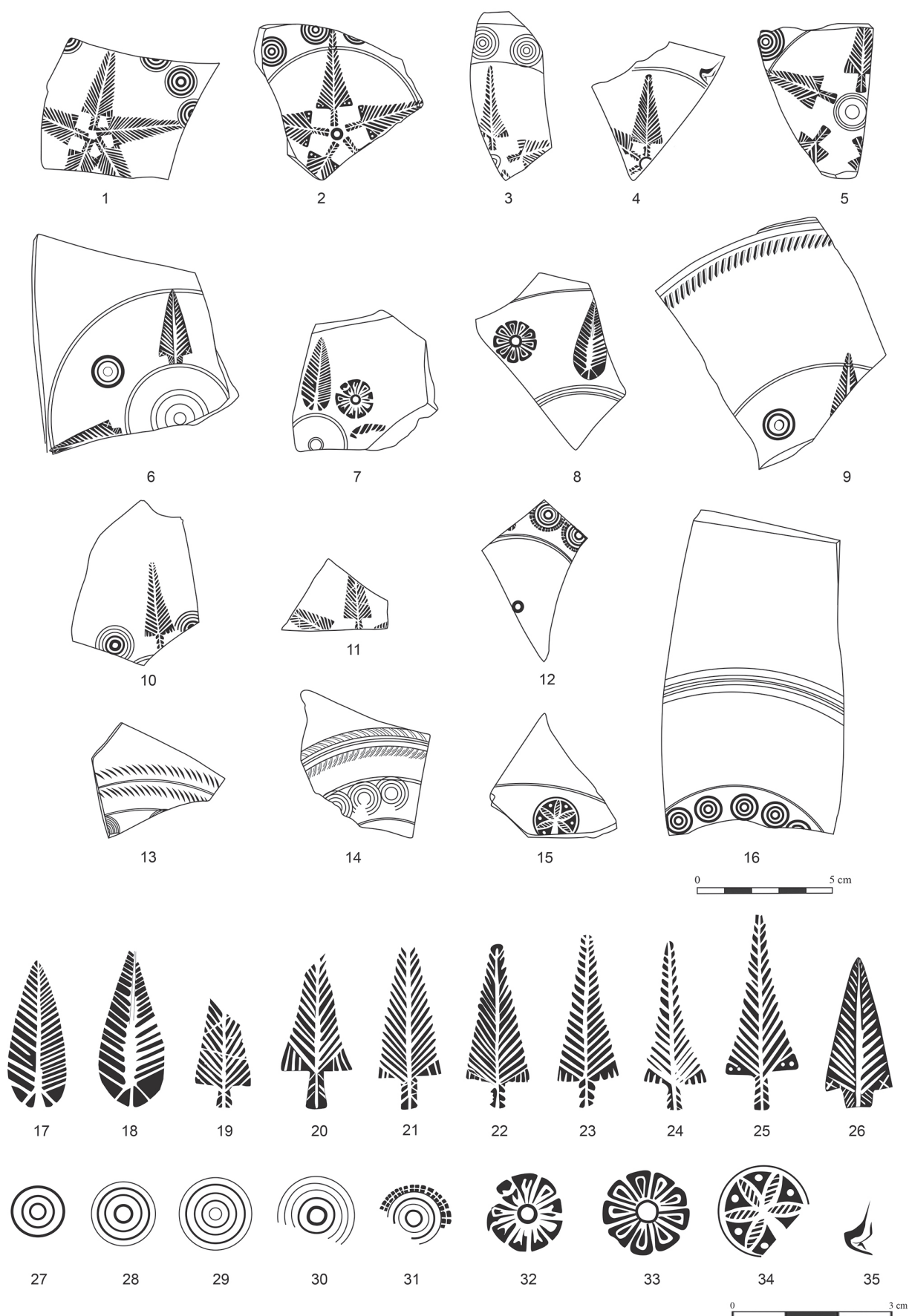


Fig. 3. Henchir el Guellal near Djilma. 1-16 Stamp-decorated ARS Hayes 62A and 68 (style B) (6 sample no. 382; 9 sample no. 383; 16 sample no. 387; see sample nos. in Table 1); 17-35 stamp-types of style B.

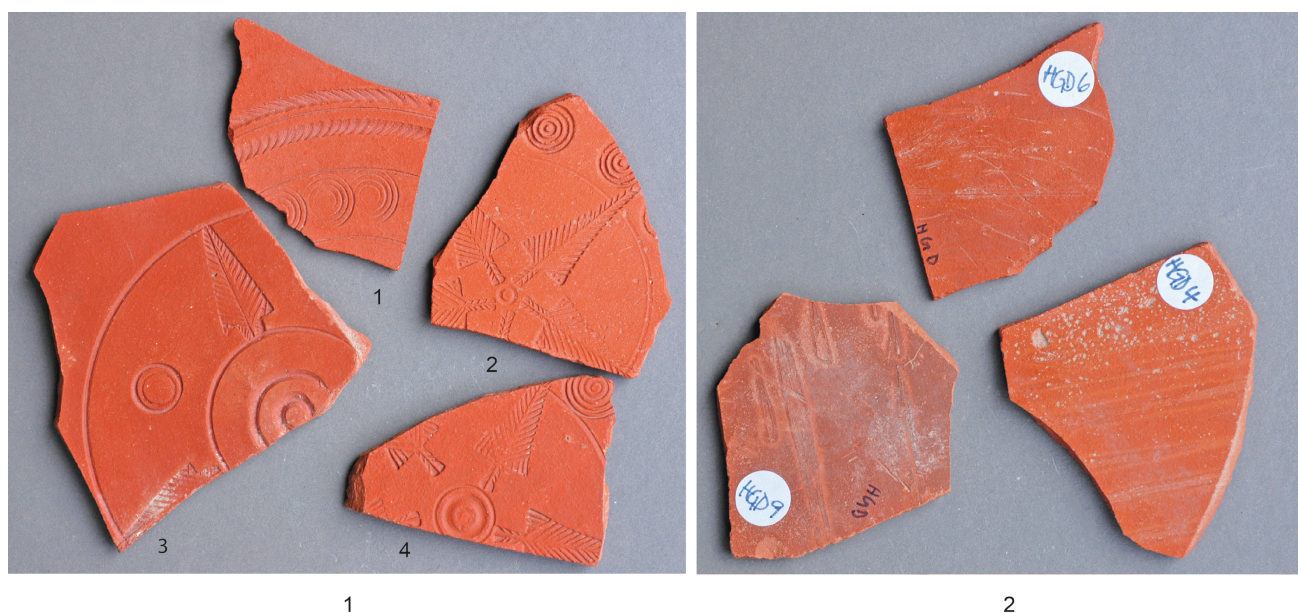


Fig. 4. Henchir el Guellal near Djilma. 1 Stamp-decorated ARS Hayes 62 A and 68 (style B); 2 twig-marks (photographs M. Mackensen). Without scale

Regarding the fabric, it should be noted that the color of the clay and slip is maroon or brownish-red. The slip on both sides is matt, the underside of the floor usually shows the characteristic twig-marks associated with the drying of the slipped vessels on grass or straw (**fig. 4, 2**). The fragments show a flaky fracture, which is granular. The clay matrix is densely to moderately tempered with well-sorted, small and very small quartz sand grains and some white lime inclusions (Mackensen and Schneider 2006: 187), which can normally be detected and observed without a magnifying glass. It should be noted that the appearance of the late Antique ARS from Djilma is uniform regarding the clay matrix, the clay and slip color as well as the twig-marks and corresponds to fabric E.¹⁴

WD-XRF analyses of samples from Djilma and other North African sites

G. Schneider and M. Daszkiewicz recently analyzed a large sample of mid Imperial and late Antique ARS and lamps from Djilma and other North African sites using wave-length-dispersive X-ray fluorescence (WD-XRF), which confirmed the previous results from 2006. The best method to define pottery production workshops is chemical analysis. An objective interpretation of the data from precise and accurate chemical analysis (**Table 1**) is more objective than subjective description of thin sections, even with automatic planimetry and granulometry. For the chemical analysis, a small amount of powder of about 1.2 grams must be taken from a sherd, possibly by drilling; this is then analyzed by WD-XRF of melted

pellets. The data in Table 1 are valid for samples ignited at 900°C with the losses on ignition (l.o.i.) given in the table.

The bivariate diagram (**fig. 5**) of the concentrations of the sum of magnesium and calcium versus potassium clearly separates three subgroups A, B, and C of ARS made in Djilma. Lamps and ARS from Djilma and the analyzed samples from other sites were obviously made from the same raw materials.¹⁵ All samples of ARS analyzed

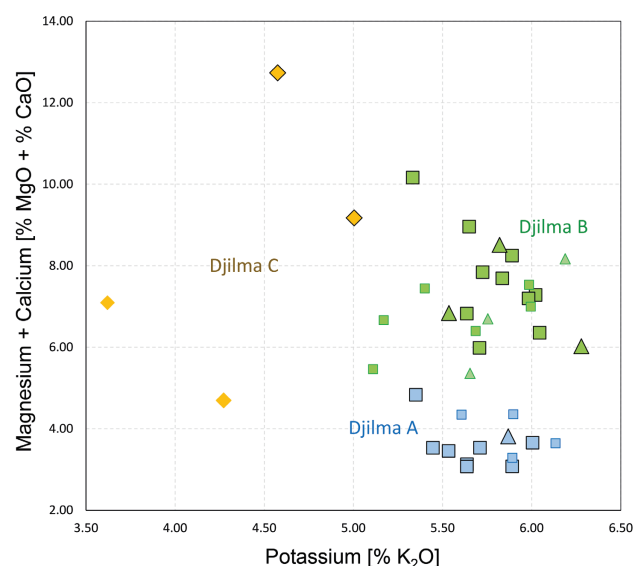


Fig. 5. Variation of magnesium and calcium versus potassium showing groups A-C in samples from Djilma.

¹⁴ From the recently discovered and surveyed late Antique ARS production site (fabric E according to M. Nasr) at Henchir en Nadhour (Majoura), c. 70 km northeast of Gafsa, no stamp-decorated ARS is known: Nasr 2015: 124-128; Nasr 2021: 4-5, figs. 3-4.

¹⁵ This was verified by a series of MGR-analyses (Daszkiewicz 2014; 2017) showing several subgroups of different clay used at Djilma and Sidi Marzouk Tounsi.

form/ type	date	sample no.	lab- no.	SiO2	TiO2	Al2O3	Fe2O3	MnO	MgO	CaO	Na2O	K2O	P2O5	V	Cr	Ni	(Cu)	Zn	Rb	Sr	Y	Zr	(Nb)	Ba	(Ce)	Lo.i.	
														ppm										%			
ARS Djilma A (subgroup with low values of magnesium and calcium)																											
ARS from Djilma																											
H. 45A	MR	147	G433	64,49	0,945	18,40	6,14	0,025	2,46	0,67	1,15	5,64	0,095	108	102	34	37	149	144	190	27	223	16	453	95	1,20	
H. 45C	MR	149	G435	63,05	0,932	19,82	5,63	0,028	2,75	0,91	0,76	6,01	0,116	104	93	37	28	66	160	157	30	203	17	449	82	1,64	
H. 50A	MR	151	G437	65,93	0,924	17,80	5,19	0,026	2,46	1,00	1,01	5,53	0,120	99	87	37	28	57	145	170	30	232	14	430	77	1,26	
H. 45B	MR	148	G434	65,70	0,940	17,73	5,65	0,028	2,53	1,01	0,86	5,45	0,119	98	94	37	32	62	143	225	29	237	14	438	80	1,15	
H. 44	MR	251	H980	66,52	0,927	17,79	4,41	0,027	2,44	1,10	0,99	5,71	0,095	66	80	34	24	52	137	185	27	229	18	505	91	1,39	
H. 45A	MR	252	H981	64,49	0,941	17,52	5,80	0,030	2,88	1,96	0,92	5,35	0,117	99	104	39	71	75	161	181	30	231	25	420	87	1,21	
H. 72	LR	384	X594	63,60	0,923	20,15	5,55	0,025	2,55	0,53	0,67	5,89	0,117	112	96	39	22	70	175	208	30	206	18	459	75	1,95	
H. 92	LR	386	X596	66,10	0,889	18,45	5,20	0,025	2,47	0,60	0,50	5,64	0,129	99	88	42	20	58	160	119	32	234	21	444	71	1,43	
lamp from Sabratha																											
Atl. I	MR	213	X886	64,39	0,927	19,10	5,30	0,028	2,58	1,23	0,45	5,87	0,121	102	92	37	26	61	151	172	32	222	16	435	77	1,82	
ARS from Vezereos																											
H. 70	LR	330	W881	66,19	0,874	17,65	4,68	0,029	2,32	2,03	0,52	5,61	0,106	77	83	35	27	51	154	183	22	263	16	518	78	2,15	
H. 68	LR	331	W882	63,30	0,894	19,41	5,59	0,035	2,97	1,39	0,36	5,90	0,145	97	89	41	28	57	172	139	24	250	16	494	86	1,53	
H. 60	LR	335	W886	65,76	0,966	17,92	5,31	0,032	2,45	0,83	0,74	5,89	0,102	95	103	48	41	111	157	133	28	213	17	522	94	0,48	
ARS from Gheriat el-Garbia																											
H. 68	LR	1031	W377	62,75	0,926	20,25	5,77	0,027	2,73	0,91	0,34	6,13	0,153	105	96	39	29	63	174	161	30	214	17	437	103	3,84	
mean (n = 13)																											
std ±																											
cv %																											
ARS Djilma B (subgroup with higher values of magnesium and calcium)																											
ARS from Djilma																											
H. 48A	MR	150	G436	60,71	0,873	18,65	6,42	0,038	3,10	3,72	0,72	5,64	0,127	114	120	42	29	65	158	420	23	173	15	386	74	1,50	
H. 58 Var.	LR	152	G438	60,25	0,785	17,91	5,59	0,064	4,70	4,26	0,66	5,65	0,132	93	83	34	23	62	142	155	28	215	15	423	89	1,13	
H. 68	LR	154	G440	59,96	0,824	18,69	6,09	0,045	3,74	3,96	0,66	5,84	0,206	77	73	32	14	52	148	294	30	181	13	390	60	1,57	
H. 66	LR	155	G441	60,80	0,811	18,15	5,78	0,057	3,65	4,20	0,69	5,73	0,139	80	88	34	28	67	143	196	27	216	15	422	88	1,45	
H. 62A/68	LR	156	G442	58,73	0,835	19,81	6,49	0,052	3,68	3,61	0,59	6,02	0,182	104	100	42	43	73	154	257	26	162	16	396	89	1,73	
H. 62A/68	LR	382	X592	59,98	0,823	19,09	6,20	0,049	3,80	3,39	0,51	5,98	0,159	105	96	39	19	65	158	308	30	211	16	414	74	1,38	
H. 62A/68	LR	383	X593	62,74	0,866	18,36	5,61	0,040	3,20	2,79	0,50	5,71	0,187	89	89	39	25	59	158	210	31	241	18	435	84	1,83	
H. 77	LR	385	X595	58,93	0,812	18,19	5,74	0,053	4,97	5,19	0,62	5,33	0,162	103	90	39	20	60	160	171	28	170	16	410	73	0,99	
H. 62A/68	LR	387	X597	60,30	0,819	19,46	6,39	0,048	3,53	2,82	0,41	6,04	0,183	101	101	43	23	63	166	234	29	178	16	413	67	1,72	
H. 70	LR	388	X598	58,29	0,810	19,30	6,50	0,056	4,44	3,81	0,73	5,89	0,173	104	100	49	26	62	167	211	28	165	16	389	68	1,57	
lamps from Djilma																											
Atl. VII A1	LR	389	X694	61,97	0,751	17,58	5,94	0,047	3,80	3,04	1,15	5,54	0,182	89	100	47	50	68	162	186	22	173	16	498	66	2,38	
Atl. VII A2	LR	390	X695	59,83	0,861	20,02	6,42	0,044	3,59	2,43	0,35	6,28	0,171	121	85	47	87	75	138	147	22	108	21	412	89	2,06	
Atl. IV A/VII A1/2	LR	394	X699	59,42	0,838	18,40	6,33	0,051	4,16	4,35	0,47	5,82	0,158	83	100	46	84	75	122	106	25	124	21	467	74	1,53	
lamp from Telepte																											
Atl. IV A	MR	395	700	60,91	0,805	18,97	6,24	0,044	3,30	3,40	0,40	5,75	0,179	101	100	46	48	73	167	159	27	166	17	432	77	1,44	
ARS from Vezereos																											
H. 45A	MR	329	880	63,81	0,865	16,97	5,87	0,038	3,15	3,51	0,49	5,17	0,125	89	88	34	28	73	155	241	20	230	14	424	88	1,75	
H. 68	LR	332	883	62,81	0,831	18,32	5,25	0,042	3,36	3,04	0,50	5,69	0,157	85	86	37	26	76	159	172	21	215	14	524	80	1,44	
H. 68	LR	333	884	59,18	0,823	19,44	6,40	0,058	4,36	3,18	0,36	5,99	0,215	106	99	47	33	64	172	148	22	187	14	522	80	1,71	
H. 49	MR	336	887	61,87	0,867	17,62	6,03	0,041	3,57	3,88	0,59	5,40	0,136	100	92	37	27	92	159	237	24	212	15	421	85	2,36	
lamp from Vezereos																											
Den. XI B	MR	337	888	57,85	0,847	19,77	6,56	0,047	4,45	3,72	0,39	6,19	0,173	107	103	41	38	70	181	180	19	168	15	421	87	1,23	
ARS from Gheriat el-Garbia																											
closed vessel	MR	1063	409	60,85	0,930	19,87	6,85	0,036	3,42	2,05	0,76	5,11	0,131	113	122	43	25	58	183	400	28	221	25	505	84	1,77	
lamp from Gheriat el-Garbia																											
Atl. IV A	MR	1026	W372	64,60	0,811	17,66	5,11	0,046	2,71	2,66	0,60	5,65	0,160	80	78	35	25	62	148	244	23	221	16	479	66	1,67	
ARS from Carthage																											
H. 62A/68	LR	n41	G679	59,09	0,837	19,70	6,67	0,056	3,94	3,06	0,47	6,00	0,194	101	106	41	31	77	161	131	27	173	19	420	91	2,07	
mean (n = 10)																											
std ±																											
cv %																											
ARS Djilma C (subgroup with lower values of potassium)																											
ARS from Djilma																											
H. 27	MR	250	H979	60,25	0,801	17,69	6,33	0,055	3,49	5,69	0,49	5,00	0,208	79	86	33	19	53	125	632	22	186	16	378	80	2,28	
H. 32	MR	153	G439	59,32	0,726	15,92	5,58	0,046	3,45	9,28	0,97	4,58	0,125	74	71	30	24	54	127	539	22	186	13	462	73	4,61	
ARS from Sabratha																											
H. 27?	MR	257	H986	67,19	0,825	15,27	5,38	0,055	2,93	4,16	0,40	3,62	0,158	83	89	34	28	67	107	242	24	247	17	467	76	1,87	
H. 32	MR	262	H991	66,50	0,928	15,89	6,57	0,039	2,60	2,10	0,99	4,27	0,116	84	98	44	40	71	120	420	27	214	16	441	81	1,86	
mean (n = 4)																											
std ±																											
cv %																											

Table 1. Chemical analyses by WD-XRF showing Djilma subgroups A-C with samples from Djilma and various sites in Tunisia and Libya (MR: Mid Roman; LR: Late Roman).

hitherto would fall outside the diagram, having values below 3% potassium oxide (K_2O) and thus can be clearly distinguished chemically. Characteristic for Djilma are the high contents of magnesium (MgO) and potassium (K_2O). In addition, it has been possible to distinguish a subgroup A with somewhat lower values of magnesium and calcium from a subgroup B with higher values of magnesium and calcium (fig. 5). Both subgroups contain ARS and lamps of the 3rd century as well as of the 4th and the first half of the 5th century. Therefore, the two subgroups cannot be of chronological relevance. However, two different clay pits are to be expected, which can be significantly distinguished by the values of the major elements.

In addition, several ARS and lamp fragments from the Tripolitanian forts of *Vezereos*/Sidi Mohammed ben Aïssa (Mackensen 2022: 189-191, fig. 2,4-12, table 1) and *Myd---*/Gheriat el-Garbia as well as from the large cities of *Karthago*/Carthage and *Sabratha* were analyzed as well (Table 1). The results could be assigned to both subgroups A and B. Subgroup C of typical A/D forms of the 3rd century with lower potassium contents is of no further importance in the given context of the late Antique range of ARS forms.

The reference group for Djilma (fig. 6, 1) can be clearly distinguished from those of Sidi Marzouk Tounsi and Henchir es-Srira (both in central Tunisia as well) in the quantitative composition of the chemical elements. This is demonstrated by plotting titanium versus potassium (fig. 6, 1) or iron versus magnesium in a bivariate diagram (fig. 6, 2). Both distinctions were already shown earlier, however with a smaller series of samples (Mackensen and Schneider 2006: 172, figs. 6-7).

Based on Peacock's and Pröttel's survey material, the range of late Roman ARS forms and the stamped decoration of the production site at Djilma can be presented (fig. 2-4.1). This also applies to the fabric, which corresponds to the characteristics of fabric E as defined by Carandini; in addition, there is the chemical reference group with mean values, which is characteristic for Djilma with the two subgroups A and B (fig. 5). It can be clearly distinguished from all other ARS potteries in northern and central Tunisia (fig. 6, 1.2). This is decisive for the earlier presumed localization of the C/E- and E-potteries in southern Tunisia, which was discussed by Bonifay in the so-called Sicily Project (*Ceramica Africana nella Sicilia Romana / CASR*). He did not consider the testimony of the chemical analyses as sufficient to prove a production of ARS in fabric E at Djilma (Bonifay 2004: 51; Capelli and Bonifay 2016: 303). It is the multiplicity of arguments (shapes, different decoration, stamp style, fabric, etc.) and in particular this evidence from the production site at Djilma (including saggars), that proves a production there of fabric E with the pottery-specific stamp-types of palm-branches type Hayes 9, 10 and 10 Var. of stamp style B. However, in any case, the strong presence of this ware in southern Tunisia and along the coast from Sfax to Gabès as well as on Djerba was never an argument for a localization of the potteries in this region. Notably, there is an absence of corresponding rejects/wasters and misfired vessel forms as well as the associated saggars and pottery tools - as Bonifay himself noted (Capelli and Bonifay 2016: 303; Bonifay

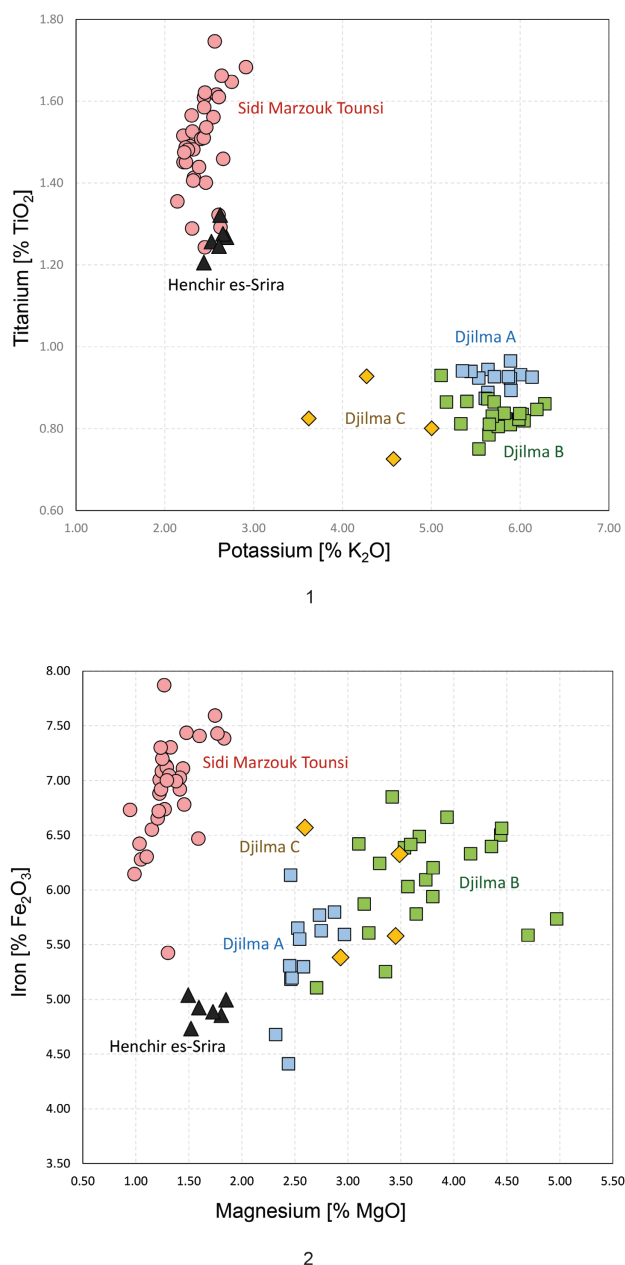


Fig. 6. 1) Variation of titanium versus potassium in samples from production centers in central Tunisia; 2) variation of iron versus magnesium in samples from production centers in central Tunisia.

2016: 524). The thin sections with microphotographic images and petrographic analyses of the few fragments that are available but cannot be determined with certainty (Capelli and Bonifay 2016: 304, fig. 80,101.362) do not lead us any further in determining fabric E and assigning it to a possible production site.

A classification of late Antique ARS from Djilma can be carried out with relative certainty based on three principal criteria: 1. Shape of various vessel forms, 2. stamped decoration (style B and individual stamp-types) and additionally herringbone bands of rouletting, 3. fabric E (clay with white inclusions, slip on inside and outside of vessel, brownish-red or maroon color) and twig-marks on underside of plates and

dishes¹⁶ and in knowledge of the survey pottery (1984/85 and 1991) from Djilma which contains a series of misfired and discolored fragments as well as rejects/wasters and cylindrical saggars with graffiti and stamped decoration.

Stamp-decorated ARS from Djilma at the Athenian Agora

This leads us back to the Athenian Agora. Unfortunately, not even selected pieces can be sampled here. Portable X-Ray fluorescence of the surface of a sherd (without powder sampling for chemical analysis) was not possible for me to organize before my stay in 2016; however, it is less representative, less precise and less secure and cannot replace powder analysis (Daszkiewicz et al. 2020). When examining the stamp-decorated ARS, however, among the large quantity of north and central Tunisian floor sherds with stamped decoration, some pieces can reliably be identified as originating from Djilma (fig. 7, 1-6).¹⁷ Fragments 1092 and 1191 (each with a double band of rouletting surrounding the stamped decoration) (fig. 7,

1.3) (Hayes 2008: 227 no. 1092, fig. 34, pl. 55; 234 no. 1191, pl. 58) come from Djilma as well as nos. 1190, 1192 and 1193 (fig. 7, 2.4.5) (Hayes 2008: 234, nos. 1190, 1192, 1193 pl. 58) because of the characteristic palm-branches (type Hayes 10 of style B), mostly combined with concentric circles as alternating motif or in an outer band of stamped decoration. This is also true for no. 1194 with a palm-branch (type Hayes 10) combined with a bird to the right (type Hayes 180) (fig. 7, 6) (Hayes 2008: 234, no. 1194 pl. 58). This figural stamp-type is known from the above-mentioned sherd of Pröttel's survey (fig. 3, 4) at Djilma¹⁸ and is probably characteristic for the latest phase of style B around c. 440/450. These fragments show twig-marks on the underside of plates and dishes and the white inclusions. Doubtless, all these fragments can be attributed to Djilma, but for the time being they can be dated within the period of c. AD 360–450, which is relevant for the forms Hayes 62A and 68.¹⁹

Equally, however, among the late Antique stamp-decorated sherds published by Hayes from the Athenian Agora, those from the north-eastern Tunisian potteries El Mahrine, Bordj el Djerbi, *atelier X* and Oudhna as well as from the central Tunisian pottery centres Sidi Marzouk Tounsi and

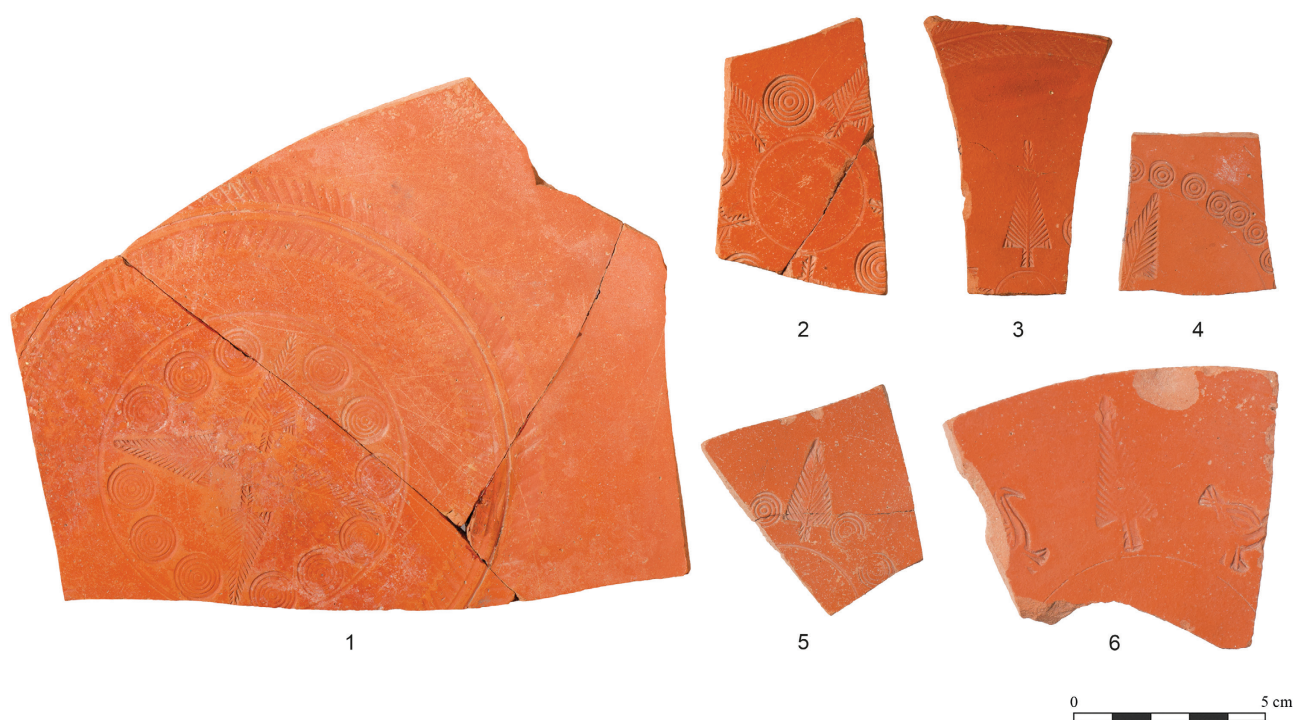


Fig. 7. Athens Agora. 1-6 stamp-decorated sherds of ARS Hayes 62A and 68 (style B). 1 no. 1092 (P 7087); 2 no. 1190 (P 177); 3 no. 1191 (P 178); 4 no. 1193 (P 6751); 5 no. 1192 (P 686); 6 no. 1194 (P 8047); nos. refer to Hayes 2008 (photographs C. Mauzy, ASCSA; Ephorate of Antiquities of Athens City, Ancient Agora, ASCSA: Agora Excavations © Hellenic Ministry of Culture and Sports/Hellenic Organization of Cultural Resources Development).

¹⁶ Twig-marks are not known on ARS from Sidi Marzouk Tounsi.

¹⁷ Permission for the publication of the photographs taken by C. Mauzy (ASCSA) was given with e-mail (prot. n. 47876/3.10.2022) by the Ephorate of Antiquities of Athens City, Ancient Agora, ASCSA: Agora Excavations © Hellenic Ministry of Culture and Sports/Hellenic

Organization of Cultural Resources Development. (H.O.C.R.E.D.).

¹⁸ For a second, slightly different stamp-type of a bird to the right on a saggur from Djilma see Peacock et al. 1990: 81, fig. 14e.f.

¹⁹ Cf. Hayes 1972, 109; 117; cf. Hayes 2008, 77-78; 234 nos. 1190-1194: late 4th into early 5th century.

Henchr es Srira can be identified. A necessary analysis of the range of stamped decoration from c. 330/340 to the mid-6th century could not be prepared for this presentation.²⁰ Djilma is a first step towards a more differentiated assessment of the supply of the Agora and a better understanding of the long-distance trade from *Africa Proconsularis* and *Byzacena* to *Achaia* with late Antique ARS vessels decorated with stamps.

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²⁰ The author is carrying out further work on the stamp-decorated ARS from the Agora.

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