Ferdinand Heimerl

AFRICAN RED SLIP WARE FROM *AUGUSTA VINDELICUM*/AUGSBURG *(RAETIA)*: RANGE OF FORMS AND CHEMICAL ANALYSES

North African pottery from Augsburg

This paper presents some results of a recent study on African Red Slip Ware (ARS), cooking ware and lamps from *Augusta Vindelicum*/Augsburg[1]. In contrast to most Raetian sites, the provincial capital Augsburg offers a significant amount of North African pottery from the late 1st to the first half of the 5th century AD[2]. That data allows for more in-depth analysis of the trade and settlement history of *Augusta Vindelicum*. The assemblage also serves as a meaningful reference for the pottery supply of *Raetia*. This article concentrates on the range and origin of North African pottery from Augsburg as well as on chemical analyses with wavelength-dispersive X-ray fluorescence (WD-XRF). Furthermore, distribution patterns of African Red Slip Ware in *Raetia* will be discussed.

African Red Slip Ware[3]

In Augsburg ARS fabrics A^1, Central Tunisian C^1, C^2, $C^{3/4}$ and North Tunisian D^1 and D^2 are known; however there is no evidence for fabrics A^2 or A/D (**table 1**)[4]. Dating from the late 1st to early 3rd century AD, Hayes forms 8 A, 14 A and 124 from currently unknown A^1 kiln sites are among the earliest forms[5]. These few examples are most likely due to individual contacts with *Africa Proconsularis* or closer delivery markets, such as *regio X* and *caput Adriae*[6].

Hayes forms 45 A, 48 A and 50 A in fabrics C^1 and C^2 show an increased presence (**table 1**) of Central Tunisian ARS (mainly from kiln sites at Sidi Marzouk Tounsi and Henchir el Guellal near Djilma); these discoveries imply that beginning with the second quarter of the 3rd century, goods from Central Tunisian production centres appear at *Augusta Vindelicum* in greater quantity[7].

In contrast to the 3rd century evidence, there is a significantly increased volume of ARS in the 4th century. The Late Roman assemblage from Augsburg includes Hayes forms 50 B, 58 A and 72 B in fabric $C^{3/4}$ from Central Tunisia[8]. The quantity of dishes Hayes form 50 B in fabric $C^{3/4}$ suggests that Augsburg was still supplied with Central Tunisian products during the second half of the 4th century[9].

Beginning in the middle of the 4th century, North Tunisian forms (D^1 and D^2) begin to dominate over Central Tunisian products ($C^{3/4}$) at Augsburg (**table 1**). The amount of North Tunisian Hayes forms 50 B, 58 B, 59 A/B and early examples of Hayes form 61 A indicate intensified trade beginning in ca. 340/350[10]. Hayes forms 50 B no. 61, 52 B, 61 Transitional, 61 B, 67, 67 variants, 67/71, 91 variant and 91 A/B in North Tunisian fabrics D^1 and D^2 are also present. The majority is made up by dishes Hayes 59 A/B, 61 A, 61 Transitional and particularly Hayes form 61 B. Stamped decoration in style Hayes A (I)–(III) is attested on twenty base sherds (Hayes forms 59, 61 and 67) from D^1 and D^2 kiln sites[11].

The latest dateable ARS finds from the 5th century include Hayes form 50 B no. 61, Hayes form 61/El Mahrine 4.3–4/Bonifay Sig. Type 37 Var. A/B 1–2, Hayes form 61 B/Bonifay Sig. Type 38, Hayes 67, 67/71, 72 B and 91 A/B. Their quantity implies that Augsburg was supplied with North African pottery in the first quarter of the 5th century, possibly into the mid-5th century[12].

The large amount of North African pottery in Augsburg is associated with a broad market and a local demand for high-quality tableware in the provincial capital. Distribution maps of Late Roman African pottery within *Augusta Vindeli-*

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1 Heimerl 2014; for former studies on ARS from Augsburg see Bakker 1985; Mackensen 2007; id. 2013, 356–357.

2 Heimerl 2014, 138–145; North African pottery from 63 excavations from 1928 until 2011 was examined.

3 For the following range of ARS forms from Augsburg see Heimerl 2014, 21–47.

4 Heimerl 2014, 21–22; 134–135 tab. 2. – For details on forms and fabrics see Hayes 1972, 287–292; Atlante 1981, 19–78; Mackensen/Schneider 2002; Mackensen/Schneider 2006; Bonifay/Capelli/Brun 2012.

5 Bakker 1985, 70; Mackensen 2007, 344–347; Heimerl 2014, 22–25. – For the discussion on the provenance of fabric A see Mackensen/Schneider 2006, 168–169; Bonifay/Capelli/Brun 2012, 44–46.

6 Mackensen 2007, 350–351; Heimerl 2014, 64–65.

7 Mackensen 2007, 348–350; Heimerl 2014, 25–28; 69 fig. 8. – For the start of production at Sidi Marzouk Tounsi and Henchir el Guellal near Djilma see M. Mackensen, Production of 3rd century sigillata A/C (C^{1-2}) or 'el-Aouja' ware and its transition to sigillata C^3 with appliqué decoration in Central Tunisia. RCRF Acta 38, 2003, 279–286; M. Mackensen, The study of 3rd century African red slip ware based on the evidence from Tunisia. In: D. Malfitana/J. Poblome/J. Lund (eds.), Old Pottery in a New Century. Innovating Perspectives on Roman Pottery Studies. Atti del convegno internazionale di studi Catania, 22–24 Aprile 2004. Monogr. Istituto Beni Arch. Mon. C.N.R 1 (Catania 2006) 113–114; Mackensen/Schneider 2006, 165–167.

8 Heimerl 2014, 29–31.

9 Hayes 1972, 73; Pröttel 1996, 33; J. W. Hayes, Roman pottery. Fineware imports. The Athenian Agora 32 (Princeton, NJ 2008) 75; Heimerl 2014, 70.

10 Heimerl 2014, 69–72.

11 Bakker 1985, 73 no. 36–38; Mackensen 2013, 359 fig. 152,5–6; Heimerl 2014, 42–44.

12 Mackensen 2013, 357; Heimerl 2014, 74.

ARS (after Hayes 1972, Mackensen 1993, Bonifay 2004, Ben Moussa 2007)								
Hayes 1972	**Mackensen 1993**	**Bonifay 2004**	**Ben Moussa 2007**	**Fabric**	**Rim sherd**	**Base sherd**	**Base sherd?**	**Body sherd?**
8 A		3		A^1		1		
124				A^1	2	1		1
14 A		5		A^1	3			
Not classified				A^1				2
45 A				C^1, C^2	2	1		4
48 A				C^2	1			
50 A				C^2	5	12	18	13
50 B				$C^{3/4}$	15	5	7	33
58 A				$C^{3/4}$	2			
72 B				$C^{3/4}$	1			
50 B Var.			1.1–3	D^2	3			
50 B no. 61		65		D^2	1			
52 B	17.4			D^1	1			
58 B	1.1–3			D^1, D^2	7			
59 A/B	2			D^1	15	2		1
61 A	4.1			D^1	2			
61 A	4.2			D^1	10			
61 Trans.	4.3	37 Var. A/B 1		D^1, D^2	3			
61 Trans.	4.4	37 Var. A/B 2		D^1, D^2	3			
61 Trans.		37 Var. A/B 3		D^2	2			
61 Trans.		37 Var. A/B 4		D^1	1			
59/61 A				D^1		9		
61 B		38 Var. B 1		D^2	10			
61 B		38 Var. B 1/2 (?)	6.2	D^2	10			
61 B		38 Var. B 2		D^2	9			
61 B		38		D^2		8		
61 B/67				D^2			6	7
67	9.1	41 Var. B		D^1	2			
67	9.2	41 Var. C		D^1	1			
67	9.3	41 Var. B		D^1	1			
67	9	41		D^1, D^2		3		6
59/61 A/67				D^1		10		
67 Var.			16.2	D^2	2			
Not classified				D^2	2			
59/61/67 (stamps)				D^1, D^2		20		
67/71	14.4			D^1	2			
67/71/73 (?)				D^2				2
91 A/B	52.1–3			D^1, D^2	8	2		4
91 Var.		48		D^2	1			
Not classified				D^1, D^2			18	51
Cooking ware (after Hayes 1972, Bonifay 2004)								
Hayes 1972		**Bonifay 2004**			**Rim sherd**	**Base sherd**	**Base sherd?**	**Body sherd?**
23 B		Cul. (A) 1			1			1
181		Cul. (B) 5 (Var. C)			2	1		
181 Var.		Cul. (A) 3 Var. C			1			
182		Cul. (B) 6 Var. B			1			
Lamps (after Hayes 1972, Atlante 1981, Bonifay 2004)								
Hayes 1972	**Atlante 1981**	**Bonifay 2004**						
	Atlante I–IV A/VII A1?				1			
I B	Atlante VIII A1	Lampe 45			4			
I B	Atlante VIII A2	Lampe 45			5			
I	Atlante VIII				3			
I					2			
I A?	Atlante VIII B?	Lampe 43			1			
I A	Pierced lamp handle				2			
II A	Atlante X A	Lampe 54			2			

Table 1. Augsburg. Range and quantity of African Red Slip Ware, cooking ware and lamps (after Heimerl 2014, 134–135 tab. 2).

Fig.	Lab. no.	SiO_2	TiO_2	Al_2O_3	Fe_2O_3	MNO	MgO	CaO	Na_2O	K_2O	P_2O_5	V	Cr	Ni	Zn	Rb	Sr	Y	Zr	(Nb)	Ba	(Ce)	(Pb)	l.o.i.	Sum
		major elements in per cent by weight										trace elements in parts per million (ppm)													
ARS																									
A[1] or A[2]																									
Fig. 1,1	V140	70,19	1,102	18,81	5,38	0,023	1,09	0,89	0,23	2,20	0,081	127	112	32	55	86	187		431		256	83		0.87	
Fig. 1,2	V139	63,99	1,257	22,97	6,32	0,013	1,39	1,28	0,25	2,43	0,093	143	133	28	79	103	236		321		277	88		1.25	
Fig. 1,3	W978	69,05	1,127	19,61	5,61	0,032	1,26	0,85	0,13	2,26	0,081	114	120	37	77	87	165	21	324	26	268	134	33	0,98	100,22
Henchir el Guellal near Djilma																									
Fig. 1,4	W983	64,01	0,841	18,36	5,17	0,038	2,68	2,41	0,49	5,68	0,326	86	93	37	65	169	141	23	243	14	459	93	15	1,32	100,18
El Mahrine																									
Fig. 1,5	B564	71,64	1,002	17,58	5,08	0,015	1,25	0,48	0,23	2,64	0,093	84	111	32	54	112	215	25	312		316	82		1,35	98,62
Fig. 1,5a	W995	72,08	1,023	17,12	5,18	0,018	1,27	0,49	0,13	2,60	0,093	84	114	36	57	114	235	33	406	24	385	74	48	1,26	101,89
Fig. 1,6	W989	72,35	0,976	16,50	5,26	0,028	1,35	0,50	0,18	2,74	0,127	107	120	30	50	127	269	26	428	16	268	86	16	0,85	99,90
Fig. 1,7	W994	72,44	0,982	17,03	4,83	0,019	1,32	0,65	0,12	2,51	0,103	103	120	28	71	115	250	26	433	17	290	88	19	0,96	100,20
Fig. 1,8	W993	72,37	1,069	17,16	4,86	0,020	1,23	0,38	0,18	2,65	0,077	91	98	32	65	105	183	26	436	24	336	80	40	0,87	97,31
Groupe D[2]																									
Fig. 1,9	W987	78,04	0,949	13,37	4,05	0,022	0,99	0,31	0,05	2,15	0,063	71	89	25	56	86	91	28	675	17	315	81	15	0,65	98,78
Oudhna																									
Fig. 1,10	W981	70,31	0,886	14,78	6,31	0,036	2,04	2,10	0,47	2,77	0,290	88	99	36	101	93	264	29	297	23	395	77	25	1,57	99,76
Fig. 1,11	W986	73,42	0,842	14,92	5,04	0,016	1,28	1,84	0,31	2,18	0,148	87	98	27	64	80	217	20	417	14	408	72	17	1,29	100,00
Sidi Khalifa																									
Fig. 2,1	V528	74,58	0,890	15,50	4,98	0,020	1,14	0,62	0,29	1,90	0,078	70	91	24	58	80	200	21	397	16	263	67	20	0,96	100,17
Fig. 2,2	V529	75,01	0,921	14,82	5,11	0,039	1,18	0,56	0,36	1,93	0,065	67	107	37	74	76	173	22	329	20	329	62	8	1,50	102,29
Fig. 2,3	W980	74,26	0,973	15,62	5,02	0,022	1,16	0,50	0,40	1,96	0,075	83	89	33	69	84	162	20	428	21	306	91	24	1,08	99,42
Fig. 2,4	W982	76,56	0,858	14,32	4,48	0,015	1,02	0,55	0,27	1,84	0,078	91	96	24	43	79	258	16	417	13	237	73	17	0,61	99,24
Fig. 2,5	W988	75,17	0,875	14,93	4,89	0,019	1,07	0,95	0,20	1,76	0,130	79	95	22	50	80	191	18	419	15	300	78	18	0,87	100,19
Fig. 2,6	W990	76,32	0,806	14,02	4,86	0,022	1,07	0,72	0,22	1,86	0,096	66	100	23	52	83	167	17	443	14	269	71	21	0,96	100,01
Fig. 2,7	W991	74,33	0,866	15,69	5,10	0,030	1,05	0,82	0,23	1,81	0,072	86	107	29	65	81	172	20	402	17	266	87	17	0,94	100,09
Fig. 2,8	W985	73,50	0,902	16,21	5,13	0,025	1,15	0,90	0,23	1,84	0,109	99	110	29	71	87	173	20	415	16	250	69	18	0,84	100,41
Fig. 2,9	W984	75,16	0,864	15,21	4,72	0,023	1,09	0,84	0,22	1,79	0,091	90	98	27	57	83	160	21	422	14	271	74	16	1,04	100,13
Fig. 2,10	W998	72,24	0,955	16,52	5,91	0,035	1,23	0,76	0,37	1,91	0,080	79	99	35	85	75	144	18	311	22	314	29	44	2,21	100,84
Fig. 2,11	W997	75,36	0,846	14,51	5,23	0,022	1,14	0,64	0,34	1,86	0,067	75	98	32	70	73	148	18	337	17	332	49	43	0,56	98,05
Fig. 2,12	W992	73,45	0,848	14,91	5,73	0,028	1,47	1,10	0,27	2,08	0,100	74	110	43	81	84	158	29	319	18	439	20	33	1,15	101,75
Lamps																									
Tunisia (without specification)																									
Fig. 2,13	V530	65,09	0,925	19,67	8,02	0,060	2,04	1,29	0,84	1,98	0,084	129	156	113	116	137	87	38	176	20	489	90	33	1,01	98,39
Similar fabric A[1] or A[2]																									
Fig. 2,14	V531	67,07	1,078	19,05	6,58	0,050	1,62	0,81	0,73	2,86	0,150	112	110	35	90	122	206	30	373	21	400	99	20	1,15	100,21
Sidi Marzouk Tounsi																									
Fig. 2,15	W996	69,17	1,276	18,39	5,19	0,035	1,73	0,72	0,84	2,58	0,061	98	111	43	96	106	223	46	381	29	593	100	37	1,05	99,52

Table 2. Augsburg. Results of chemical analyses (WD-XRF) of African Red Slip Ware and lamps (after HEIMERL 2014, 133 tab. 1).

cum indicate that there was no reduction in settlement during the 4th and first half of the 5th century[13].

Cooking ware

North African cooking ware is represented with only a few casseroles, dishes and one lid fragment of Hayes forms 23 B, 181, 181 variant and 182 (**table 1**)[14]. Nevertheless, the presence of these vessel forms is highly remarkable since North African cooking ware is scarcely attested in *Raetia*[15]. The examples from Augsburg are thought to be associated with a small influx of people into the province with Mediterranean cooking habits[16].

Lamps

Seventeen lamp fragments and three partially to fully-intact North African lamps were found in Augsburg (**table 1**)[17]. Finds include lamp types that were hereto unknown in *Raetia* (e.g. type Atlante I–IV/VII A1(?), type Atlante VIII B variant, not classified type with pierced handle)[18]. Most frequent are lamps of the types Atlante VIII A1 and A2. These forms can be dated between the middle of the 4th and the first half of the 5th century[19]. A lamp of type Atlante X A1a/A2 and a fragment type Atlante X A1 may have been produced in the first half of the 5th century[20]. In comparison with other Raetian sites, the number of Late Roman lamps is relatively high in Augsburg. This might not only be due to continued excavation but could rather indicate the demand of a wealthy clientele in the provincial capital[21].

Chemical analyses (WD-XRF)

A selection of ARS and lamp fragments was subjected to chemical analyses[22]. The samples were chosen e.g. to verify the North African origin of rare forms that were not yet attested in *Raetia*. When macroscopical analyses were uncertain or indicated a not yet attested origin for certain vessel forms, fabrics should be defined chemically. The origin of significant stamp types was also of interest. Furthermore, variants of dishes Hayes form 61 B were analysed in terms of their morphological development within North African potteries. Analyses were executed via wavelength-dispersive X-ray fluorescence (WD-XRF) by G. Schneider and M. Daszkiewicz[23]. It was possible to relate the samples from Augsburg to reference groups of specific pottery manufacturing centres that were established by M. Mackensen and G. Schneider[24]. The results are presented in **table 2**, with major elements normalized to a constant 100% and trace elements given in parts per million (ppm)[25].

Two Hayes form 124 inkwells of late 1st and 2nd century date (**fig. 1,1–2**) were already chemically classified as fabric A and published by M. Mackensen[26]. A fragment of Hayes form 14 A (**fig. 1,3**) of the late 2nd/early 3rd century[27] was also assigned to (as of yet unknown) fabric A kiln sites.

A rim sherd from a Hayes form 58 A dish (**fig. 1,4**), dating from ca. 290/300 to ca. 375[28], was attributable to Henchir el Guellal near Djilma.

Former analysis classified the only appliqué-decorated fragment Hayes form 52 B no. 22/El Mahrine 17.4 (**fig. 1,5**) as fabric D^1 from El Mahrine, dating to the late 4th/early 5th century[29]. A base sherd (**fig. 1,5a**) from the same excavation in Augsburg is highly similar in its chemical composition[30]; these two fragments are most probably part of the same bowl. A flat-based dish Hayes form 61 Transitional/Bonifay Sig. Type 37 Var. A/B4 (**fig. 1,6**) from El Mahrine is dateable to the first third of the 5th century[31]. Two fragments of flanged bowls (**fig. 1,7–8**) were also found to originate from El Mahrine, where production of Hayes forms 91 A/B/El Mahrine 52.1–3 started in ca. 400(/420)[32].

A sample of Hayes form 61 Transitional/Bonifay Sig. Type 37 Var. A/B2 (**fig. 1,9**), dating to the first half of the 5th century[33], corresponds to the fabric of the D^2 group. Unfortunately, this was not assignable to a specific pottery-manufacturing centre.

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13 Heimerl 2014, 74–83 with figs. 12–13 (distribution maps of ARS in Augsburg).

14 Heimerl 2014, 47–51. – For further details on forms and fabrics see Bonifay 2004, 211–231; Ikäheimo 2003, 17–71.

15 Apart from Augsburg only one fragment of North African cooking ware (bodysherd, Hayes form 181) is documented at the Lorenzberg near Epfach (M. Mackensen, Spätrömische nordafrikanische Keramik vom Lorenzberg bei Epfach – eine Neubewertung der Funde aus den Ausgrabungen 1953–1957. Bayer. Vorgeschbl. 80, 2015, 185 cat. no. 23). – On the distribution of North African cooking ware at inland sites in the Mediterranean see Ikäheimo 2003, 119–121; V. Leitch, Reconstructing history through pottery: the contribution of Roman N African cookwares. Journal Roman Arch. 26, 2013, 286–295.

16 Heimerl 2014, 65.

17 Ibid. 51–61.

18 Ibid. 54–59.

19 Atlante 1981, 195; Mackensen 1993, 147; Pröttel 1996, 71–76; Bonifay 2004, 359–364.

20 Hayes 1972, 314; Atlante 1981, 200; Mackensen 1993, 151–152; Bonifay 2004, 373–382; Mackensen 2013, 356.

21 Heimerl 2014, 72.

22 For further details on chemical analyses see ibid. 17–19; 133 tab. 1.

23 Ibid. 133 tab. 1; the author is very grateful to G. Schneider (Arbeitsgruppe Archäometrie, TOPOI, Free University Berlin) and M. Daszkiewicz (Archea, Warsaw) for the provision and interpretation of the results of the WD-XRF analyses; the analyses were funded by Augsburg City Archaeology and Pro Augusta: Für Archäologie in Augsburg e.V.

24 For reference groups via WD-XRF see Mackensen/Schneider 2002; Mackensen/Schneider 2006; for further X-ray fluorescence analyses see Brun 2004; id. 2007.

25 Ignition losses (l.o.i.) are indicated so that analyses could be recalculated to dry conditions.

26 Mackensen 2007, 345–347 fig. 1,2–3; 347 tab. 1 (V139; V140).

27 Hayes 1972, 41; J. W. Hayes, A Supplement to Late Roman Pottery (London 1980) 514–515; Pröttel 1996, 27; Bonifay 2004, 159. – For a longer floruit see J. C. Quaresma, Chronologie finale de la sigillée africaine A à partir des contextes de Chãos Salgados (Mirobriga?): différences de facies entre Orient et Occident. In: M. Á. Cau/P. Reynolds/M. Bonifay (eds.), LRFW 1. Late Roman fine wares. Solving problems of typology and chronology. A review of the evidence, debate and new contexts (Oxford 2011) 77–83.

28 Hayes 1972, 95–96; Pröttel 1996, 34.

29 Mackensen 2013, 356; 354 fig. 149,10; 359 fig. 152,3; 350 tab. 10, no. 20 (B564).

30 Data compared by G. Schneider.

31 Bonifay 2004, 167–168 fig. 90; 171. – For similar forms from El Mahrine see Mackensen 1993 pl. 53.7–9; Ben Moussa 2007, 84 fig. 14,2–3.

32 Mackensen 1993, 430–431; Pröttel 1996, 50.

33 Bonifay 2004, 167; 171.

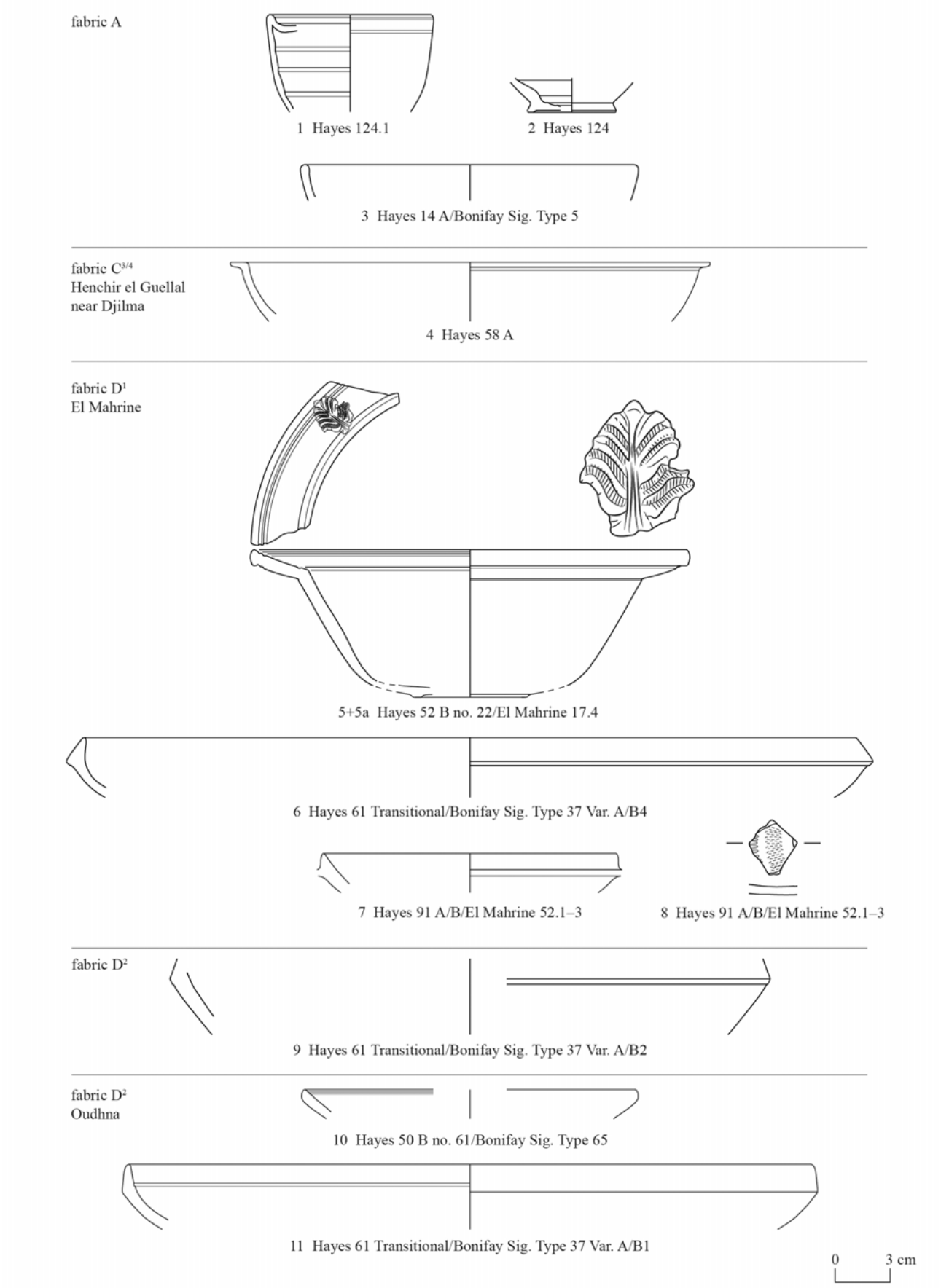

Fig. 1. Augsburg. Chemically analysed (WD-XRF) fragments of African Red Slip Ware. – Scale 1:3. Appliqué decoration no. 5 Scale 1:1.

M. Bonifay located the production of Hayes form 50 B no. 61 in Sidi Zahruni and dated this form (Bonifay Sig. Type 65) to the first half of the 5th century AD[34]. According to chemical analysis of a rim sherd from Augsburg (**fig. 1,10**), Hayes form 50 B no. 61 was not only produced in Sidi Zahruni, but also in Oudhna. Furthermore, Hayes form 61 Transitional/Bonifay Sig. Type 37 Var. A/B1 (**fig. 1,11**) in fabric D[2] was made in the surroundings of Oudhna in the first half of the 5th century[35].

The standard dish Hayes form 50 B was produced on a large scale in Central Tunisian workshops, while *Pheradi Maius*/Sidi Khalifa was proven to be a North Tunisian production centre for these dishes[36]. Three analysed vessels of Hayes form 50 B from Augsburg (**fig. 2,1–3**) correspond to the Sidi Khalifa reference group and were probably produced in the second half of the 4th and early 5th century[37]. A flat-based dish (**fig. 2,4**) of Hayes form 58 B (similar Hayes form 32/58) can now be attributed to the range of dish forms from *Pheradi Maius* for the first time. Hayes form 58 B was produced from the late 3rd/early 4th century to the mid or the third quarter of the 4th century[38].

The samples from Augsburg include Hayes form 61 Transitional/Bonifay Sig. Type 37 Var. A/B3 (**fig. 2,5**), Hayes form 61 B/Bonifay Sig. Type 38 Var. B1/B2[39] (**fig. 2,6**) and Hayes form 61 B/Bonifay Sig. Type 38 Var. B2[40] (**fig. 2,7**). These different variants of Hayes form 61 of the first half of the 5th century were also produced in Sidi Khalifa[41]. Analyses proved the same origin for Hayes form 67 variant (**fig. 2,8**), dating from the mid-4th to the mid-5th century[42]. A similar, but not definitely identifiable rim sherd (**fig. 2,9**) was also attributed to *Pheradi Maius*. Stamped decoration of concentric circles within a square grille-pattern[43] (**fig. 2,10**) and another stamp of specific leaf-sprays[44] (**fig. 2,11**) were previously considered to be characteristic of the pottery centre of Sidi Khalifa. The provenance from Sidi Khalifa is confirmed for both analysed samples from Augsburg.

The flanged bowl Hayes form 91/Atlante 1981 pl. 48.11/ Bonifay Sig. Type 48 (**fig. 2,12**) is probably a precursor of Hayes form 91 A/B and dateable to the second half of the 4th century[45]. Chemical analyses on such bowls from Oudhna seem to imply local production[46]. According to the sample from Augsburg (**fig. 2,12**) Sidi Khalifa was most likely another production site for this form.

It is remarkable that a significant proportion of the chemically analysed assemblage at Augsburg originated from *Pheradi Maius*/Sidi Khalifa. Whether this high percentage is representative for the whole supply of Augsburg and the provinces of *Raetia prima et secunda* can only be attested by larger series of WD-XRF analyses.

Chemical analyses were also conducted on lamp types that are scarcely attested in Augsburg and *Raetia*. Because of its fragmentary condition a small shoulder fragment of type Atlante I–IV or VII A1(?) could not be classified with certainty (**fig. 2,13**). Nevertheless, this is the first example of North African mid Roman lamps in *Raetia*[47]. The sample was isolated geographically to Tunisia by chemical analysis, but could not be assigned to a certain pottery manufacturing centre.

A fragment with floral relief decoration on the shoulder and a central rosette on the discus (**fig. 2,14**) may be evidence for a variant of type Atlante VIII B. These lamps date to the second half of the 4th century[48]. WD-XRF analysis displays that the lamp belongs to the chemical reference group associated with ARS fabric A.

The type of pierced lamp handle (**fig. 2,15**) cannot be specified, but chemical analysis makes an attribution to Sidi Marzouk Tounsi probable.

Using WD-XRF, even small fragments were able to be identified as North African products. This increases the general understanding of the supply of *Augusta Vindelicum* with respect to North African pottery. Furthermore, it was possible to add forms of currently unknown origin to the range of products from specific potteries by chemical analyses.

Distribution of African Red Slip Ware in *Raetia*

Distribution maps based on recent work of S. Gairhos, A. Höck and M. Mackensen illustrate the supply of *Raetia prima et secunda* with North African pottery[49]. Apart from Augsburg only a few findspots of ARS (Chur, Bürgle near Gundremmingen, Innsbruck-Wilten, Kempten, Pfaffenhofen, Regensburg) are known from the late 1st to the early 4th century[50]. From about the mid-4th century to the first half of the 5th century larger quantities of ARS are attested in various urban centres, hill-top settlements and smaller settlements in both Raetian provinces (**fig. 3**)[51]. Trade routes for African pottery appear to follow north-south axes over the Alps from northern Italy[52]. The quantity and variety of North African

34 Ibid. 57; 197; T. Ghalia/M. Bonifay/C. Capelli, L'atelier de Sidi-Zahruni: Mise en évidence d'une production d'amphores de l'Antiquité tardive sur le territoire de la cité de Neapolis (Nabeul, Tunisie). In: J. M. Gurt I Esparraguera/J. Buxeda I Garrigós/M. A. Cau Ontiveros (eds.), LRCW 1. Late Roman coarse wares, cooking wares and amphorae in the Mediterranean. Archaeology and archaeometry. BAR Internat. Ser. 1340 (Oxford 2005) 496; 504 fig. 5,29–30.

35 Bonifay 2004, 167; 171.

36 Atlante 1981, 65; Pröttel 1996, 32; Mackensen/Schneider 2006, 183; Ben Moussa 2007, 133 fig. 45 form Pheradi Maius 1.1–3; Brun 2007, 570; 575 fig. 2,7; 577 fig. 5 (ACD 457; ACD 96).

37 Ben Moussa 2007, 133–134.

38 Hayes 1972, 95–96; Pröttel 1996, 42–43; Mackensen 1993, 398.

39 Similar Ben Moussa 2007, form Pheradi Maius 6.2.

40 Similar ibid. fig. 46.5 and 46.7.

41 For forms and dating see Bonifay 2004, 167–171.

42 Similar Ben Moussa 2007, 141 form Pheradi Maius 16.2.

43 Atlante 1981, 126 pl. 56,60; Mackensen 1993, 31 fig. 5,12; 446.

44 Hayes 1972, stamp type 77B: chevrons formed of two converging leaf-sprays with sprays pointing downwards; Mackensen 1993, 446–448.

45 Mackensen 1993, 431; Bonifay 2004, 179.

46 Brun 2004, 242 (ACD 124, reference group Oudhna B).

47 Heimerl 2014, 54–55; 72.

48 For detailed discussion of the decoration see Heimerl 2014, 57–58; for dating see Bonifay 2004, 358.

49 S. Gairhos, Archäologische Untersuchungen zur spätrömischen Zeit in Curia/Chur GR. Jahrb. SGUF 83, 2000, 117; A. Höck, Archäologische Forschungen in Teriola 1. Die Rettungsgrabungen auf dem Martinsbühel bei Zirl von 1993–1997. Spätrömische Befunde und Funde zum Kastell. Fundber. Österreich Materialh. A 14 (Horn 2003) 56–61; Mackensen 2007, 350–351; id. 2013, 352–358; Heimerl 2014, 83–91 with figs. 14–17.

50 Heimerl 2014, 84–85, fig. 15.

51 Ibid. 85–89 fig. 16; for the list of sites see ibid. 139–145 (list 3 and 5).

52 For a detailed discussion on distribution of ARS in *Raetia* see ibid. 83–91.

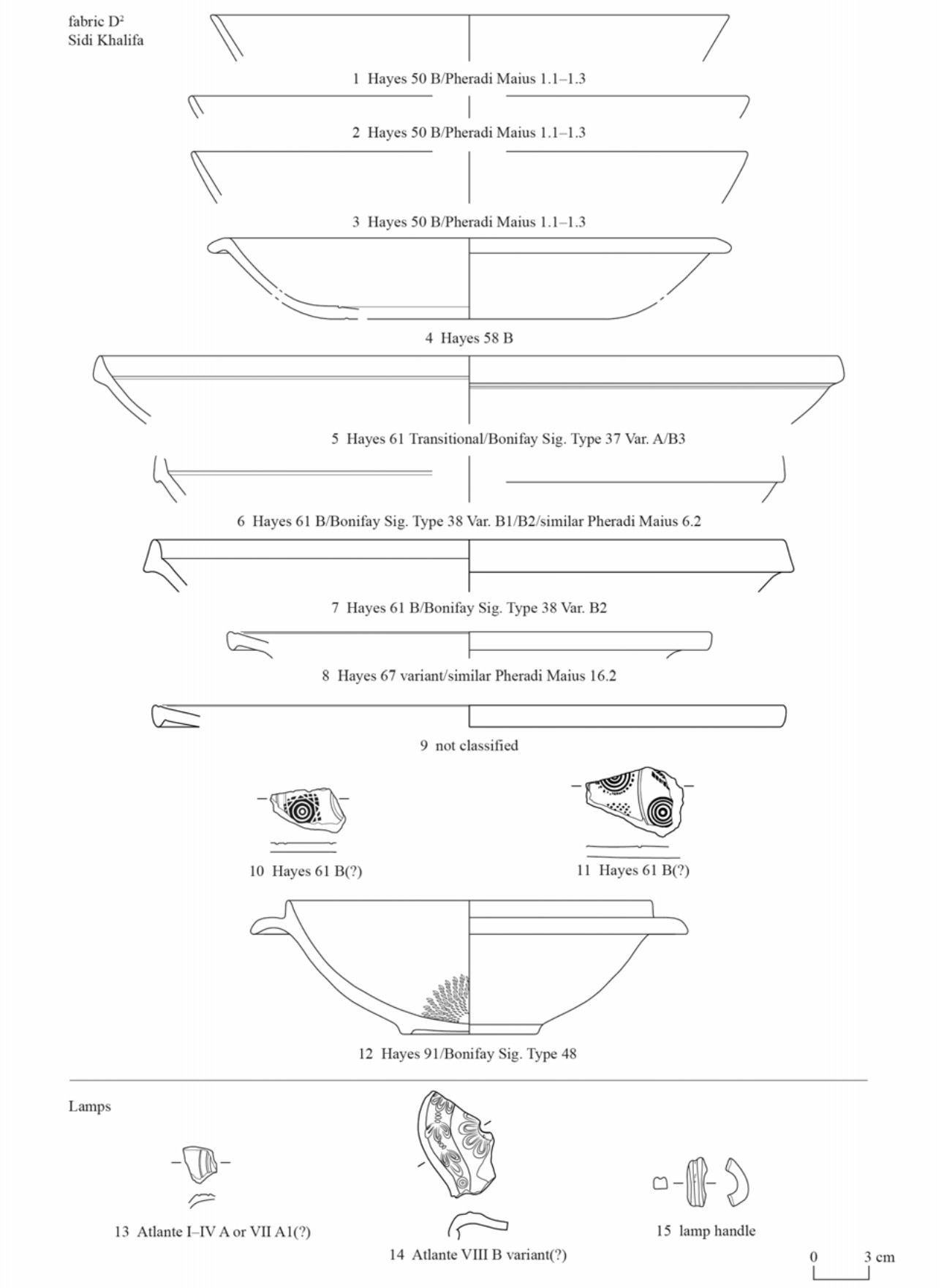

Fig. 2. Augsburg. Chemically analysed (WD-XRF) fragments of African Red Slip Ware and lamps. – Scale 1:3.

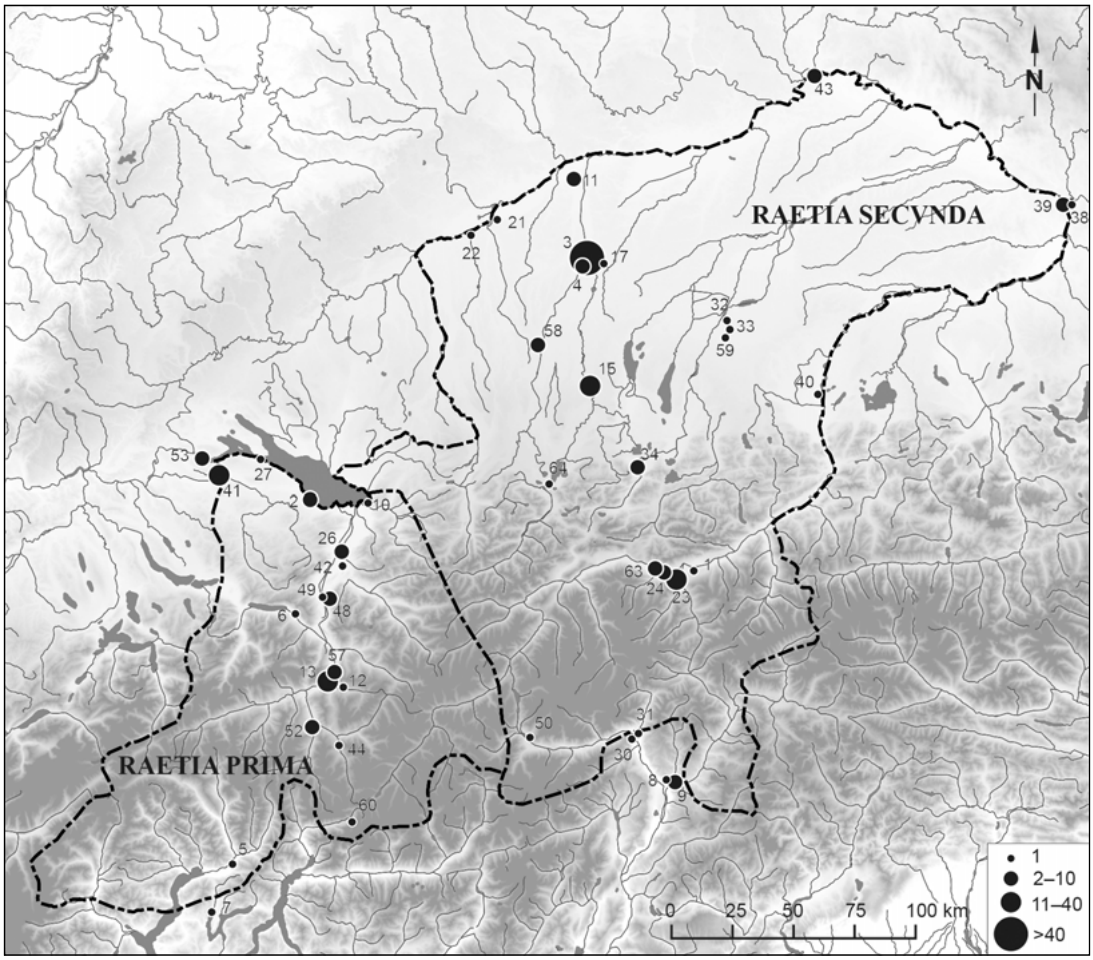

Fig. 3. African Red Slip Ware in *Raetia prima et secunda* and from external sites near the provincial border (4th and first half of 5th century AD; after Heimerl 2014, 87 fig. 16). **1** Ampass, Widenfeld; **2** Arbon; **3** Augsburg; **4** Augsburg-Göggingen; **5** Bellinzona, Castelgrande; **6** Georgenberg near Berschis; **7** Bioggio; **8** Bozen-Gries; **9** Bozen, Kapuzinerkloster; **10** Bregenz; **11** Burghöfe near Mertingen; **12** Carschlingg near Castiel; **13** Chur; **15** Lorenzberg near Epfach; **17** Friedberg, Am Fladerlach; **21** Bürgle near Gundremmingen; **22** Günzburg; **23** Innsbruck-Wilten; **24** Kematen, Michelfeld; **26** Koblach; **27** Konstanz; **30** Marling near Meran; **31** Zenoburg near Meran; **32** München-Denning; **33** München-Perlach; **34** Moosberg near Murnau; **38** Passau-Innstadt; **39** Passau, Kloster Niedernburg; **40** Pfaffenhofen; **41** Pfyn; **42** Rankweil-Brederis; **43** Regensburg; **44** Riom-Parsonz; **48** Schaan, Kastell; **49** Krüppel ob Schaan; **50** Ganglegg near Schluderns; **52** Burg Hohenraetien near Sils im Domleschg; **53** Stein am Rhein, Kastell Burg; **57** Trimmis; **58** Goldberg near Türkheim; **59** Unterhaching; **60** Crep da Caslac near Vicosoprano (Bregaglia); **63** Martinsbühel near Zirl; **64** Füssen, Schlossberg.

Red Slip Ware, cooking ware and lamps in Augsburg stand out in particular within the overall ceramic assemblage of *Raetia*. At forts and settlements on the upper Danube and in the northeastern part of *Raetia secunda*, ARS is completely absent or found only in minor quantities. Finds of ARS in *Raetia* dating from the middle of the 5th century onwards are slight. The latest dateable isolated finds (from ca. 450/480 onwards) were discovered in Regensburg, Passau-Niedernburg, the North Tyrolean Inn Valley and the Alpine Rhine Valley[53]. Notably, none come from Augsburg.

Conclusion

In contrast to most Raetian sites, *Augusta Vindelicum*/Augsburg offers a significant amount of North African pottery. The quantity and variety of finds may be associated with a local demand for high-quality tableware and lamps in the provincial capital. Chemical analyses (WD-XRF) allow for differentiated conclusions concerning the supply of Augsburg with North and Central Tunisian products. WD-XRF samples from Augsburg also contribute to our understanding of the range of forms that were produced in specific pottery-making centres in Tunisia. North African pottery from Augsburg is a crucial archaeological source for trade and the settlement history of *Augusta Vindelicum* and serves as a meaningful reference for cross-regional comparative studies.

[53] Ibid. 89–91 fig. 17.

HeimerlFerdinand@aol.de

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