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Architectural terracottas from Akragas : investigating monumental roofs from the Archaic and Classical period

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4 RESULTS

4.1 STYLISTIC TYPOLOGY

This section is comprised of the stylistic description and analysis of the architectural terracottas from Akragas. The format is based on conventions as seen in the publications by Wikander, Conti, and Lang.¹ This includes a description of the decoration, profile and size of elements as well as the provenance, publication history, and dating for each stylistic group (section 3.2).

The stylistic groups used in this discussion are based on the friezes identified by De Miro (frieze A-I).² As discussed in section 3.2, these established groups will be retained for the descriptive and analytical portions of this work. A small number of fragments published by De Miro were not assigned to a frieze, but were instead categorized according to the function such as antefixes and acroteria palmettes. These categories are sometimes numbered, as with the palmettes, but in other cases the fragments are described as single objects without a named typological group. In the interest of consistency, the functional groups identified by De Miro are relabelled in this chapter, for example: palmette A, antefix B, etc. The friezes and functional categories named by De Miro are clearly marked in the title of the stylistic groups in the following. As discussed in section 2.1, he only published around 84 fragments, while the number of fragments used in this study is 265. Thus, using De Miro's established framework, additional fragments are either added to existing friezes or functional groups, or when necessary, new functional groups are created. Furthermore, the information for each individual fragment, including functional type, provenance and museum information, is provided in appendix A.

The analytical component of this chapter is given in the following discussion section for each stylistic group. This analysis centres on evaluating the placement of the relevant fragments into a single stylistic group and the position of this group in relation to the wider regional context. The frieze categories established by De Miro are based on known terracotta fragments at the time of publication in 1965. The relevance of these attributions therefore requires a re-evaluation based on what is known about Sicilian material today. To this aim the discussion will include references to stylistic precedents seen in the terracotta roofs of Sicily. Such precedents are important indicators for today's dating of objects based on style and will be a key factor in the discussion on stylistic influences in chapter 7.

4.1.1 FRIEZE A (DE MIRO)

Provenance: A large number of fragments were found by Marconi during excavation of temple G. According to Marconi some of the finds were uncovered by farmers who had a vegetable garden in the cella before the time of the first investigation, but he does not specify which ones. The majority of fragments are presumed to come from the excavation itself.³

Fragments: 43 fragments in total. 24 sima fragments: VIN 253-257, 260, 261, 265, 267, 277, 278, 280-286, 294, 296-299, 355. 10 geison revetment fragments: VIN 258-259, 262-264, 266, 276, 295, 331, 354. 9 waterspout fragments: VIN 287-293, 621, 622 (figure 4.1-1-2).

1 Conti 2012; Lang 2010; Wikander 1986.

2 De Miro 1965.

3 Marconi 1933, pp. 115, 124.

Description:**Sima:**

Profile	Size	Painted decoration
Top roll 1	Average: 20 mm (range: 18-23 mm)	Horizontal black and white blocks with three black lines
Top roll 2	21 (13-22)	Horizontal red and white blocks with three black lines
Top fascia	43 (41-44)	Interlocking black and red hooked meanders separated by vertical black line
Cavetto	179 (based on the reconstructed sima VIN 355)	Alternating red and black standing thin tipped leaves outlined in black. Small thin tipped leaves hanging. Small red leaves are to the right of the large leaves. At the top of the cavetto between the large standing leaves are small three leaved palmettes. Leaves are separated by a thin black line
Intermediate roll	23 (20-26)	Diagonal black lines on a white background
Lower fascia	85 (84-86) Waterspout disk 189 mm in diameter	Lateral sima: One rosette on a black background between waterspout and sima edge. Two rosettes on a red background between two waterspouts. Rosettes have between 9-10 petals. Rosette is 38 mm in radius. Gable sima: Large meander pattern in black. Waterspouts are unpainted, tapering down in diameter to a large disk. The disks are painted in a number of different patterns, including a number of rosette variations
Bottom roll	21 (19-23)	Horizontal white and black blocks with three black lines

Angle of incline on lateral sima: 14 degrees average. Range 12-15 degrees.

Geison revetment:

Top roll	Average: 21 mm (range: 20-22 mm)	Red and white rectangular blocks with three black vertical lines
Main plaque	Estimated: 220 Radius of guilloche is 58 mm	Double guilloche consisting of three strands of almost equal thickness in black, white, and red. Central decoration is a black disk. Between patterns are palmettes, likely with 5 leaves each
Bottom roll 1	19 (18-19)	Red and white rectangular blocks with three black vertical lines
Bottom roll 2	15 (14-16)	Black and white rectangular blocks with three black vertical lines
Horizontal plaque	78 (74-80)	Alternating red and black single meanders in separated by black line

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Figure 4.1-1: Lateral Sima and geison revetment from frieze A (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Discussion: The development of the canonical Sicilian sima is described in section 2.2.1.1. With the thin tipped leaves on the cavetto, meander on the top fascia and the rosettes between the waterspouts, frieze A is representative of the second phase of stylistic development dated to between 570 and 530 BC.⁴ The combination of the specific decorative schemes and profile elements does not have an exact precedent among the roofs from Sicily. However, there are close parallels where individual decorative elements are used in a similar fashion. For example, the use of a meander on the top fascia, the cavetto decoration and the horizontal bands on the rolls is similar to objects from Syracuse including a geison revetment from the via Minerva⁵ area and two from the temenos around the Apollonion.⁶ Based on style Lang dates these

4 Lang 2010, pp. 37-38; Wikander 1986, p. 17; Winter 1993, p. 276.

5 Lang 2010, p. 138, no. Syra 9, fig. 32.2; Wikander 1986, p. 46, no. 57, fig. 9.

6 Lang 2010, pp. 138-139, no. Syra 14-15, fig. 34.1-5; Wikander 1986, pp. 47-48, no. 66, 70, fig. 11, 13.

roofs to the period 570-530 BC as well. From Selinus comes another example of unknown attribution with some similarities to frieze A. These include the use of a meander on the top fascia and diagonal lines on the intermediate roll, but as a whole there are substantial differences. The object is dated to the 2nd quarter of the 6th century BC by later scholars including Lang and Conti.⁷ A number of fragments from Gela have strong parallels to various decorative elements of frieze A from Akragas. Frieze B from Gela is similar in that rosettes are found between the waterspouts, the intermediate roll has diagonal bands and the sima cavetto design shows strong similarities.⁸ Frieze C from Gela is comparable as well, as seen in the decoration of the double rolls with horizontal bands and three thin stripes. The sima decoration has strong parallels except that the rosettes are on the gable pieces, and not the lateral sima. Brea dates the roof to just after the middle of the 6th century, while Lang places it in the first quarter of the same century.⁹

These Sicilian examples differ from frieze A from Akragas in that none of the simas have a bottom roll. The meander patterns on the top fascia are also running meanders, not single interlocking hooked meanders. These features are found on a roof from Selinus, on which a meander pattern is also visible on the raking sima. Both Conti and Lang date the roof to the last quarter of the 6th century due to features such as the bead-and-reel decoration on the lateral sima, which is absent from frieze A.¹⁰

The painted decoration and profile of the geison revetment is consistent with other examples from the canonical Sicilian sima phase (section 2.2.1.1). In general, there are less variation compared to the sima objects. The painted decoration, therefore, has strong similarities with a large number of Sicilian roofs including especially frieze A, B, and C from Gela. In terms of profile, the closest parallel is frieze C with the soffit plaque and double roll at the bottom. The painted decoration also comprises a guilloche pattern which consists of a black disk in the centre and the palmette is made of three leaves. There are also close parallels in the painted decoration to roofs from Selinus, except that these have a six leaved palmette inserted in between the double guilloche.¹¹

In conclusion, based on parallels with other Sicilian roofs, frieze A is representative of canonical Sicilian roofs from the second development phase. The profile and painted decoration are comparable to roofs from Gela, Syracuse, and Selinus, to name a few. Nevertheless, as seen in the discussion above, the exact configuration of profile elements and painted decoration in frieze A is not found on any of the known examples from Sicily.

The majority of the fragments identified with this frieze belong to the lateral geison revetment and sima. Two of the reconstructed pieces are also from the eaves (VIN 354, 355, figure 4.1-1), while a third is a horizontal geison revetment (VIN 276).¹² In addition, De Miro identified one fragment from the raking sima (VIN 296, figure 4.1-2)¹³ and another fragment with a decreasing guilloche pattern that he attributes to the raking geison revetment (VIN 331, figure 4.1-2). This fragment is rather small, but based

7 Conti 2012, pp. 43-67, roof 3, fig. 41; Lang 2010, p. 132, no. Seli 5, fig. 29.1-5; Wikander 1986, pp. 40-41, no. 45, fig. 11.

8 Brea 1949, pp. 39-42, fig. 28; Wikander 1986, pp. 33-34, no. 7, fig. 8.

9 Brea 1949, pp. 47-56, fig. 36-39; Lang 2010, pp. 94-95, no. Gela 3, fig. 4.5-6, 5.1; Wikander 1986, p. 34, no. 8.

10 Conti 2012, pp. 113-127, roof 14, fig. 108; Lang 2010, pp. 131-132, no. Seli 3, fig. 28.6-8.

11 Conti 2012, roof 5, 10, 12, 13.

12 Some of the reconstructed pieces are currently stored in the magazine, but the complete set is visible in the museum catalogue by Carratelli & Fiorentini 1992, fig. 80.

13 De Miro 1963, pp. 43-44.

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Figure 4.1-2: Fragments associated with frieze A (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo)

on the profile as well as the position and dimensions of the guilloche pattern De Miro places it as part of a corner decrease on the raking geison revetment. From the absence of painted decoration it is clear that the preserved edge is not from a visible soffit, as would be expected if it were part of the horizontal sima.¹⁴ This is a rather unconventional reconstruction as the majority of roofs from Gela,¹⁵ Naxos,¹⁶ and Syracuse¹⁷ show the decrease on the horizontal geison revetment. The only comparable example is frieze C from Gela, but the evidence for this reconstruction is also limited.¹⁸ Overall, the painted decoration on this fragment is not very precise and the fragment is rather small. An unconventional reconstruction of the gable based on it alone is thus problematic.

The raking sima fragment (VIN 296) has the same painted decoration on the cavetto as the lateral sima, except that the relationship between standing and hanging leaves of the same colour on the cavetto is inverted. This situation is also found on four other sima fragments, including one fragment with the remains of a waterspout (VIN 277, 282, 285, 297). In addition, there are also three fragments with slight variation in the meander pattern; namely the dividing line between the interlocking hooked meanders is omitted (VIN 280, 286, 299). At least three of these fragments are published by De Miro as being part of frieze A (VIN 277, 282, 286) and their museum numbers all fall within the range of other known fragments from this group. The variations in the painted decoration might be due to later replacement pieces or due to inconsistent execution by the craftsmen during production.

Dating: While Marconi placed the roof in the beginning of the 6th century,¹⁹ both De Miro and Lang date the roof convincingly to the middle of the 6th century.²⁰

Publications: Carratelli & Fiorentini 1992, p. 82, fig. 80; Darsow 1938, p. 12; De Miro 1965, pp. 40-55; Lang 2010, p. 86, AKRA 1; Marconi 1933, pp. 120-126; Marconi 1929, pp. 155-157; Wikander 1986, p. 31, fig. 7, no 1.

4.1.2 FRIEZE B1 (DE MIRO)

Provenance: According to De Miro the provenance is not known.²¹ The museum number starts with an 'S', which indicates that it comes from the civic museum collection of Agrigento (section 2.1).

Fragments: 1 geison revetment fragment: VIN 351 (figure 4.1-3)

14 De Miro 1965, p. 49.

15 Frieze A and D from Gela, cf. Brea 1952.

16 The roof associated with tempietto H from the sanctuary to the West of Santa Venera (Lentini & Pakkanen 2011, p. 423, fig. 22).

17 The roof found in the area of the Athenaion, cf. Ciurcina 1993, p. 36, fig. 23.

18 Brea 1949, fig. 99.

19 Marconi 1933, p. 126.

20 De Miro 1965, p. 49; Lang 2010, p. 87.

21 De Miro 1965, p. 55.

Description:

Profile	Size	Painted decoration
Top roll	21 mm high	Red and white rectangular blocks with black vertical lines
Fascia	Guilloche radius 49 mm	Double guilloche consisting of three strands in black, white, and red/black. Central decoration is a black disk. Between patterns is three leaved palmette

Discussion: The geison revetment fragment has strong similarities with the geisa from frieze A and C. The painted decorations on the top roll and main plaque are similar; the main fascia is decorated with a double guilloche built from three strands around a central disk and there is a three leaved palmette in the centre.

Dating: Lang dates this object to 570-530 BC.²²

Publications: De Miro 1965, p. 55, tab. XXIV-1c; Lang 2010, p. 90, AKRA 18.

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Figure 4.1-3: Frieze B1 geison revetment fragment (VIN 351, Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.3 FRIEZE B2 (DE MIRO)

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Figure 4.1-4: Frieze B2 raking or horizontal sima fragment (VIN 349, Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

²² Lang 2010, p. 90.

Provenance: unknown,²³ museum number indicates object comes from the civic museum collection of Agrigento.

Fragments: 1 horizontal sima fragment: VIN 349 (figure 4.1-4)

Description:

Profile	Size	Painted decoration
Cavetto	-	Traces of tear shaped leaves
Top roll	26 mm	Diagonal bands in red and black
Lower fascia	67 mm high Angle between fascia and horizontal tile is 81 degrees	Three rosettes on a black background. The rosettes consist of eight or nine petals with a central black disk

Discussion: There is no evidence of waterspouts on the lower fascia. The space required for the three rosettes visible, and the fact that the connection with the horizontal plaque covers more than half of the lower fascia, indicates that there were no waterspouts present. Thus, this fragment is from either the raking or the horizontal sima.

The painted decoration has strong similarities with frieze A as well as three roofs from Gela and one from Syracuse. The strongest similarities are with frieze F from Gela which Lang dates to 570-530 BC.²⁴ Two other roofs with similar painted decoration are dated to the same period by Lang, frieze A²⁵ and frieze B from Gela.²⁶ There are also similarities with a lateral sima from Syracuse which is placed in the same period.²⁷

In terms of the profile, VIN 349 is set apart from other simas from Akragas dated to the this period. Unlike the ones from frieze A, B3, and D this fragment does not have a bottom roll. According to Shoe the bottom roll is a characteristic of Selinuntine simas.²⁸ The situation seems to be slightly more complicated for while it appears the bottom roll is restricted to simas from Selinus and Akragas the recent publication by Conti demonstrates that there are a number of early simas from Selinus where the bottom roll is also absent, including roof 1²⁹ and roof 3.³⁰

Dating: Lang dates the object to 570-530 BC.³¹

Publications: De Miro 1965, p. 55, tab. XXIV-1d; Lang 2010, p. 87, AKRA 4.

4.1.4 FRIEZE B3 (DE MIRO)

Provenance: A single sima fragment was found during the excavation at S. Anna by Fiorentini next to the large rectangular structure dated to the end of the 6th century BC (VIN 358, figure 4.1-5).³² During recent

23 De Miro 1965, p. 55.

24 Brea 1949, pp. 62-63, fig. 51-53; Lang 2010, p. 96; Wikander 1986, p. 35, fig. 7.

25 Brea 1949, pp. 22-38, fig. 14-26; Lang 2010, pp. 93-94, fig. 4; Wikander 1986, pp. 32-33, fig. 1,7.

26 Brea 1949, pp. 39-47, fig. 27-35; Lang 2010, p. 94, fig. 4; Wikander 1986, pp. 33-34, fig. 8.

27 Lang 2010, pp. 137-138, fig. 33.1; Wikander 1986, pp. 44-46, fig. 5,12.

28 Shoe 1952, p. 10.

29 Conti 2012, pp. 32-33, fig. 15.

30 Conti 2012, pp. 53-56, fig. 40-41.

31 Lang 2010, p. 87.

32 De Miro 1965, p. 56; Fiorentini 1969, p. 67.

excavations by Sojc three additional fragments were discovered in secondary use to the North-East of Fiorentini's excavation. These fragments have not yet been published.

Fragments: 3 sima fragments: VIN 358, 569, 562. 1 geison revetment fragment: VIN 570 (figure 4.1-5)

Description:

Sima:

Profile	Size	Painted decoration
The top section is not represented by any of the known fragments		
Intermediate roll	Average: 23 mm (range: 22-23 mm)	Unclear
Lower fascia	85 (82-88)	Rosette on a black background between waterspout and sima edge
Bottom roll	21 (20-22)	Unclear

Angle of incline on lateral sima: 13 degrees average. Range 11-14 degrees.

Geison revetment:

Top roll	21 mm in diameter	Unclear
Main plaque	Unclear	Unclear

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Figure 4.1-5: Frieze B3 lateral sima fragments (Copyright VIN 358 : Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo. Copyright VIN 562,569 and 570: Parco Archeologico e Paesaggistico Valle dei Templi di Agrigento).

Discussion: The three new fragments (VIN 562, 569, 570) are placed together with the one known

fragment from Fiorentini's excavation (VIN 358) since all fragments are from a canonical Sicilian roof and similar in size, and they were found in the area of the extra-urban sanctuary of S. Anna. Two fragments are associated with the lateral entablature, one from the sima (VIN 358) and the other from the lateral geison revetment (VIN 570, figure 4.1-5). A third, larger fragment, appears to be from the raking sima, since the fragment is big enough that traces of waterspouts would have been visible in the lower fascia if it came from the lateral sima (VIN 562). The last sima fragment is rather small and might belong to either the raking or the lateral sima (VIN 569). The painted decoration on the three new fragments is eroded and the geison revetment fragment shows evidence of secondary burning. The fragment from Fiorentini's excavation retains some of the painted decoration though. It shows a strong similarity with frieze A both in terms of the painted decoration and the profile. The size of the rosette as well as its position within the lower fascia are identical. The angle of the fascia and the stepped join are also the same.

Dating: Lang dates the fragment from Fiorentini's excavation to 570-530 BC.³³

Publications: De Miro 1965, p. 56, tab. XXIV-1g; Fiorentini 1969, p. 67, fig. XXXII.2.2; Lang 2010, pp. 87-88, AKRA 5.

4.1.5 FRIEZE B4 (DE MIRO)

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Figure 4.1-6: Sima fragment from frieze B4 (VIN 352, Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: De Miro does not provide any information on the provenance.³⁴ The museum number starts with 'S', an indication that it originally comes from the civic museum of Agrigento. Other objects that fall within the same range of museum numbers include fragments from frieze A (VIN 277, 278, 280, 284, 285, 297), frieze B1 (VIN 351) and frieze B2 (VIN 349) (see appendix A).

On the back of the fragment is a small white sticker with a blue border and the text: S. 24 P.D. R.B N.5. The sticker and text are similar to ones found on objects from frieze A. For example, on VIN 278 is a sticker with the text: S. 24 P.B R.B N. 6. Although there are some discrepancies since the text associated with fragments from frieze A includes P.B, while on this fragment it is P.D. To date no other corresponding documentation on objects has been found. It therefore appears that it is linked to the excavations of

³³ Lang 2010, p. 88.

³⁴ De Miro 1965, p. 55.

Marconi, but it is important to note that Marconi investigated the urban sanctuary the year before he excavated at temple G when he uncovered fragments associated with frieze A (section 2.1). One other fragment from his urban sanctuary excavation (VIN 279) is within the same group of fragments from the civic museum. Similarities in the excavation documentation between objects from these excavations would therefore not be surprising.

Fragments: 1 sima fragment: VIN 352 (figure 4.1-6)

Description:

Profile	Size	Painted decoration
Top fascia	55 mm high	Hooked meander
Cavetto	-	Standing thin tipped leaves with possible small thin tipped leaves hanging. Between leaves is a solid black wavy band

Discussion: While the fragment has a similar documentation system as objects from frieze A (see provenance above) the painted decoration and profile size are different. The top fascia is almost 1 cm higher and decorated with a hooked meander, while frieze A has an interlocking hooked meander. The standing leaves within the wavy band are also much wider than the ones seen on frieze A. The painted decoration is similar to the drawings published by Gábrici of the terracotta revetment found at the naiskos to the South-East of temple B (frieze D).³⁵

Dating: Lang dates the fragment to 570-530 BC.³⁶

Publications: De Miro 1965, p. 56, tab. XXIV-1b, fig. 2; Lang 2010, p. 88, AKRA 6.

4.1.6 FRIEZE B5 (DE MIRO)

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Figure 4.1-7: Sima fragment from frieze B5 (VIN 353, Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: The provenance of this fragment is not published by De Miro.³⁷

Fragments: 1 sima fragment: VIN 353 (figure 4.1-7)

³⁵ Gábrici 1925, fig. 10-11.

³⁶ Lang 2010, p. 88.

³⁷ De Miro 1965, p. 57.

Description:

Profile	Size	Painted decoration
Top roll 1	-	Unclear
Top roll 2	21 mm high	Red horizontal block with black vertical lines
Top fascia	25 mm high	Alternating black and red dog-tooth
Cavetto	-	Alternating red and white thin tipped standing leaves on a white background with a black outline. Small hanging leaves in between. Appears to have black Doric/tear shaped leaves on back

Discussion: The use of a dog-tooth pattern on the top fascia is relatively rare with only two examples, one from Leontini³⁸ and the other from Megara Hyblaea.³⁹ The cavetto decoration is very similar to frieze A. While there is only one incomplete fragment of frieze B5, the size of the top fascia as well as the decoration and curve of the cavetto indicate a smaller sima than frieze A. A stepped join is preserved on the lateral edge.

Dating: Lang dates this fragment to 570-530 BC.⁴⁰

Publications: De Miro 1965, p. 57, tab. XXIV-1a, fig. 2c; Lang 2010, p. 88, AKRA 7.

4.1.7 FRIEZE B6 (DE MIRO)

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Figure 4.1-8: Sima fragment from frieze B6 (VIN 333, Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: The provenance of this fragment is not published by De Miro.⁴¹

Fragments: 1 sima fragment: VIN 333 (figure 4.1-8)

38 Wikander 1986, p. 38, fig. 7.

39 Lang 2010, p. 112, fig. 13.3.

40 Lang 2010, p. 88.

41 De Miro 1965, p. 57.

Description:

Profile	Size	Painted decoration
Top roll	21 mm high	Black and white horizontal blocks
Top fascia	40 mm high	Four rows of black and white checkerboard
Cavetto	-	Unclear

Discussion: The sima fragment is one of the few examples from Akragas of black and white painted decoration. While the decoration is well preserved on only the top roll and fascia, there is no indication of other painted colours. A number of examples from elsewhere in Sicily exist with similar decoration and profile. These include an earlier raking sima from Selinus,⁴² frieze B from Gela dated by Lang to the middle of the 6th century,⁴³ and smaller fragments from Syracuse.⁴⁴

Dating: Lang dates this fragment to 570-530 BC.⁴⁵

Publications: De Miro 1965, p. 57, tab. XXVII-3a; Lang 2010, p. 88, AKRA 8. Frieze C (de Miro)

4.1.8 FRIEZE C (DE MIRO)

Provenance: De Miro identifies VIN 200 and 201 as being from a fill layer around the naiskos to the South-East of temple B found during his excavation in 1962.⁴⁶ According to the museum inventory documentation the other two fragments are from the same area.

Fragments: 4 geison revetment fragments: VIN 198-201 (figure 4.1-9)

Description:

Profile	Size	Painted decoration
Top roll	22 mm	Red and white rectangular blocks with three black vertical lines
Main plaque	Guilloche radius 51 mm	Double guilloche consisting of three strands in black, white and red/black. The middle strand is slightly thinner. Central decoration is a black disk. Between patterns are three leaved palmettes.
Bottom roll 1	Average: 20 (range: 18-21)	Red and white rectangular blocks with three vertical lines
Bottom roll 2	15	Rectangular blocks with three vertical lines

Discussion: De Miro appears to populate this frieze with geison revetment fragments that were found in a disturbed context in the area around the naiskos to the South-East of temple B. While he only placed two fragments (VIN 200 and 201) in this group, there are two other fragments in the storerooms of the archaeology museum of Agrigento which are recorded as being from the same excavation and find context.

This geison revetment frieze has very strong similarities to frieze B1 in terms of the size of the elements

42 Conti 2012, pp. 32-33, fig. 15; Lang 2010, p. 131, fig. 27.3-4, 28.1-3; Wikander 1986, p. 42, fig. 10.

43 Brea 1949, pp. 39-47, fig. 27-35; Lang 2010, p. 94, fig. 4; Wikander 1986, pp. 33-34, fig. 8.

44 Lang 2010, p. 138, fig. 32.3; Wikander 1986, pp. 46-47.

45 Lang 2010, p. 88.

46 De Miro 1965, p. 57.

and the painted decoration. VIN 201 has a flat lateral edge preserved.

Dating: Lang dates these fragments to the 6th century BC.⁴⁷

Publications: De Miro 1965, p. 57; Lang 2010, p. 89, AKRA 15.

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Figure 4.1-9: Sima fragments from frieze C (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.9 FRIEZE D (DE MIRO)

Provenance: When Gábrici excavated the naiskos to the South-East of temple B, he discovered over a hundred fragments of a terracotta roof similar to that of the Geloan treasury in Olympia. These fragments were found in the upper floor layers and are thought to come from the collapse of the building.⁴⁸ While the majority of these fragments are now lost, 17 were recently rediscovered in the archaeological museum in Palermo (VIN 500-516). According to the find tags stored with these objects they are from inside the naiskos. In 1962 De Miro excavated in the same area and uncovered a handful of additional fragments. One of them (VIN 196) he attributes to the sima found by Gábrici.⁴⁹ Three additional fragments were never published. According to the text written on the objects themselves they were also found in 1962, close to the Hellenistic fortification to the South of temple B (VIN 574, 612, 614).

Fragments: 21 fragments in total. 7 sima fragments: VIN 196, 503, 504, 506-508, 612). 14 geison revetment fragments: VIN 195, 500-502, 505, 509-515, 574, 614 (figure 4.1-10)

⁴⁷ Lang 2010, p. 89.

⁴⁸ Gábrici 1925, p. 440.

⁴⁹ De Miro 1965, p. 58.

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Figure 4.1-10: Fragments associated with frieze D (Copyright VIN 196 and 614: Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo. Remaining objects copyright Regione Siciliana – Assessorato Reg.le dei BB. CC. e I. S. – Su concessione del Polo Regionale di Palermo per i Parchi e i Musei Archeologici– Museo Archeologico Regionale "Antonino Salinas" – divieto di duplicazione con qualsiasi mezzo)

Description:**Sima**

Profile	Size	Painted decoration
Top roll 1	19 mm	Horizontal black and white blocks with three black lines
Top roll 2	21	Horizontal red and white blocks with three black lines
Top fascia	-	Single hooked meanders alternating in red and black
Cavetto	-	Black wavy band with white outlines. Alternating red and black infill
Intermediate roll	24	Diagonal black lines on a white background
Lower fascia	Angle between fascia and horizontal base: between 82 and 78 degrees.	On the lateral sima there are alternating red and black lozenges between the waterspouts. On the raking sima there is a 9-10 petal rosette on a white background. The rosette has a radius of 61 mm
Bottom roll	Average: 23 (range: 20-25)	Horizontal white and black blocks with black vertical lines

Angle of incline on lateral sima: 13 degrees average. Range 12-14 degrees.

Geison revetment:

Top roll	22 mm	Red and white rectangular blocks with three black vertical lines
Main plaque	186 based on the guidelines on VIN 505. Guilloche radius 42 mm	Double guilloche consisting of three strands in black, white and red/black. Central decoration is a black disk. Between patterns are three leaved palmettes
Bottom roll 1	Average: 19 (range: 18-24)	Red and white rectangular blocks with three black vertical lines
Bottom roll 2	17 (15-18)	Black and white rectangular blocks with three black vertical lines
Horizontal plaque	74 (70-78)	Single hooked meanders alternating in red and black

Discussion: During his excavation to the South-East of temple B Gábrici found numerous fragments associated with a number of different roofs. According to him the remains of the roof of the naiskos were found inside the building, while fragments from different roofs, including some associated with frieze C and G, were located in the disturbed context around the building and towards the later fortification walls. Unfortunately, none of the fragments excavated by Gábrici and interpreted with the roof of the naiskos has been published and the documentation from this investigation is minimal. The identification of objects from the roof of the naiskos, associated with frieze D, is thus dependent on the drawings published by Gábrici. Based on them De Miro assigned the sima fragment (VIN 196), excavated in 1962, to this frieze (figure 4.1-10). The fragments recently rediscovered in the archaeological museum in Palermo are assigned to frieze D, too, due to similarities with the published drawings as well as their find location inside the naiskos (VIN 500-516, figure 4.1-10). For example, VIN 505 is a lateral sima fragment with alternating red and black diamonds (figure 4.1-10). While three unpublished fragments appear to come from the disturbed context near the fortification walls (VIN 574, 612, 614) they are also assigned to

frieze D due to their similarities with the published material. For example, VIN 614 is a geison revetment fragment with preserved painted decoration on the soffit plaque consisting of alternating red and black hooked meanders (figure 4.1-10).

There are a number of concerns, however, because the majority of objects are not in a very good state of preservation, as can be seen in figure 4.1-10 and as documented in appendix A. The most important published source of information, Gábrici's drawings, raises some questions. The top fascia sits at an odd angle to the cavetto and the guilloche pattern shows a triple strand next to the palmettes, but a double strand at the outer edges. Both details are inconsistent with material from Sicily. On closer inspection of especially the geison revetment fragments such as VIN 513 it appears that the guilloche in fact consists of three strands and that the central disk is smaller than previously indicated by Gábrici.

In 1925 Gábrici estimates the sima to be 370 mm high and 520 mm long, while the geison revetment's height, based on the fragments, is 245 mm.⁵⁰ This results in the sima being slightly smaller than frieze A, while the geison revetment has the same size. As with frieze A the sima also consists of a bottom roll. Unfortunately, fragments associated with the top fascia and cavetto of the sima are rare and badly eroded; therefore, Gábrici's reconstructed drawing cannot be confirmed based on this group of objects alone.

While the decorative elements on frieze A and D show minor variations, they are all typical motifs used during the second phase of the canonical Sicilian roof as discussed in section 2.2.1.1. These decorative elements show strong similarities to various fragments found in Gela within the sanctuary of Athena, dated to the first quarter of the 6th century or the period 570-530 BC.⁵¹ There are also strong stylistic parallels to the roofs from the area of the Athenaion and Monte Casale, Syracuse, which are placed in the middle of the 6th century.⁵²

Dating: De Miro dates frieze D to the middle of the 6th century based on stylistic similarities with the Geloan treasury in Olympia.⁵³ Lang dates it to 570-530 BC.⁵⁴

Publications: Darsow 1938, p. 12; De Miro 1965, pp. 58-60, tab. XXIV-1h; Gábrici 1925, pp. 440-441, fig. 10,11; Lang 2010, p. 88, AKRA 8; Marconi 1929, p. 155, fig. 87a-b; Wikander 1986, pp. 31-32, fig. 7, no. 2.

4.1.10 FRIEZE E (DE MIRO)

Provenance: The museum number is in the middle of a range of inventory numbers that point to Gábrici's excavation to the South-East of temple B (appendix A). Some of the fragments in this range, such as VIN 180, are published by De Miro as coming from the fill layer around the naiskos (e.g. ridge tile antefix A).

Fragments: 1 geison revetment fragment: VIN 224 (figure 4.1-11)

50 Gábrici 1925, p. 141.

51 Lang 2010, pp. 94-95.

52 Ciurcina 1993, pp. 30-31, fig. 4,5.

53 De Miro 1965, p. 59.

54 Lang 2010, p. 88.

Description:

Profile	Size	Painted decoration
Doric cyma	72 mm	Alternating black and white Doric leaves with outline in white and central white stripe
Top roll	18	Unknown
Main plaque	-	Guilloche with thin outline in white and red band visible

Discussion: The profile has a rather unique feature not found on geison revetment fragments from earlier periods. The interior join between the top horizontal plaque and the main vertical plaque is fortified, creating a large, sloping joint. This indicates that VIN 224 did not sit flush with the stone geison but instead cantilevered at least 40 mm beyond the stone geison revetment. Examples of painted Doric cyma are found in a number of fragments from Selinus including roof 19, which is associated with temple C.⁵⁵ The strongest similarity show fragments from roof 20, which was formerly connected with temple Y. They are similar not only in the painted decoration but also in the profile which includes a large chamfered inner joint between the top horizontal and vertical plaques.⁵⁶ Conti dates roof 19 and 20 to be roughly similar, around 530 BC.⁵⁷ There appears to be consensus among scholars that the addition of a hawksbeak moulding, or in this case a painted Doric cyma, on top of the main geison revetment plaque is associated with the anthemion sima phase of Sicilian architectural terracottas.⁵⁸

Dating: De Miro dates this object to the last decade of the 6th century based on similarities with temple C from Selinus.⁵⁹ Lang dates it to the last third of 6th century BC.⁶⁰

Publications: De Miro 1965, pp. 60-61, tab. XXIV-2; Lang 2010, pp. 89-90, AKRA 16; Wikander 1986, p. 32, no. 3.

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Figure 4.1-11: Sima fragment from frieze E (VIN 224, Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

55 Conti 2012, pp. 184-185, fig. 166-167.

56 Conti 2012, pp. 191-193, fig. 170-173.

57 Conti 2012, p. 204.

58 Lang 2010, p. 89; Wikander 1986, pp. 26-29; Winter 1993, pp. 277-278.

59 De Miro 1965, p. 59.

60 Lang 2010, p. 90.

4.1.11 FRIEZE F (DE MIRO)

Provenance: VIN 145, 146 and 148 were found in a cistern North of temple A,⁶¹ while VIN 147, 177 and 178 came from the base of the hill.⁶² VIN 521 was recently rediscovered in the archaeological museum in Palermo among fragments of the 1922 excavation by Gábrici to the South-East of temple B.

Fragments: 7 sima fragments: VIN 145-148, 177, 178, 521 (figure 4.1-12)

Description: The anthemion sima consists of a repetition of the same design motifs in relief. Every other repetition is inverted. The different repetitions are separated vertically by perforations but tied in the middle by interwoven volutes. The two volutes are held together with a red band and have a black disk in the centre. From the red band there grows a five leaved palmette with alternating red and black leaves. On the opposing side is a lotus flower with three internal leaves. Every other repetition consist of a standing palmette with a hanging lotus. At the base of the lotus flower next to the volutes is a dog-tooth pattern in white and red. The perforated sima sits on a horizontal tile which is decorated with a single guilloche on the front. The soffit of the tile is painted with a simple meander in white with alternating red and black blocks, followed by a large solid red band until the edge of the fracture which indicates an overhang of at least 96 mm.

Discussion: VIN 521 is placed in this group based on similarities in profile and painted decoration with the other six fragments already published by De Miro. All of the seven fragments are associated with the perforated lateral sima. VIN 145, 147 and 148 are similar to VIN 178 (figure 4.1-12.a) based on their standing palmette with five leaves. The other three fragments (figure 4.1-12.b,c,d) are associated with different parts of the sima design, which accounts for their differences in profile and decoration. VIN 146, for example, is an inverted palmette, with the profile thickening towards the tips of the palmette at the bottom. VIN 177 contains an inverted lotus and a part of the horizontal tile, whereas the inverse of VIN 177 is VIN 521 which contains a standing lotus.

In general, the combination of palmette, lotus flower and volute is a common design motif on Archaic Greek objects from pottery to jewellery. The anthemion design is also a characteristic part of the Corinthian system, of which the mid-6th century temple of Apollo at Corinth is a good example.⁶³ There are only a small number of examples where the anthemion pattern is used for a perforated lateral sima. In Sicily, examples can be divided into two groups based on details in the decoration. The first group includes the frieze F from Akragas, and objects of frieze G from Akragas represent the second. The first group is sometimes referred to as the ‘Selinuntine sima’ due to three well known simas from Selinus associated with temple E1, C and Y.⁶⁴ Other examples include three simas from Metapontium dated between 540-400 BC,⁶⁵ one fragment from Leontini,⁶⁶ and an isolated fragment in secondary use found in Akrai.⁶⁷ In terms of style, size, and profile, the sima of frieze F most closely resembles roof 20 from Selinus, formerly associated with temple Y. Conti dates it to around 530 BC.⁶⁸

61 De Miro 1965, p. 63.

62 De Miro 1965, p. 62; Marconi 1929, p. 154.

63 Winter 1993, pp. 32-33, fig. 3.

64 Lang 2010, pp. 45-46; Winter 1993, p. 21.

65 Lang 2010, p. 112, tab. 14.

66 Monterosso 2009, p. 434, fig. 14.

67 Ciurcina 1997, p. 42, fig. 7-8.

68 Conti 2012, pp. 186-204, fig. 181, 184.

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Figure 4.1-12: Sima fragment from frieze F. (Copyright VIN 521 : Regione Siciliana – Assessorato Reg.le dei BB. CC. e I. S. – Su concessione del Polo Regionale di Palermo per i Parchi e i Musei Archeologici– Museo Archeologico Regionale “Antonino Salinas” – divieto di duplicazione con qualsiasi mezzo. Remaining objects copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico “Pietro Griffo” - divieto di duplicazione con qualsiasi mezzo)

Dating: Last third of 6th century BC.⁶⁹

Publications: Darsow 1938, p. 32; De Miro 1965, pp. 62-64, tab. XXV-1; Lang 2010, p. 88, tab. 1.4, AKRA 11; Marconi 1929, pp. 153, 156, fig. 86; Wikander 1986, p. 32, no. 4.

4.1.12 FRIEZE G (DE MIRO)

Provenance: The fragments are likely from the extensive fill layer in the area to the South-East of temple B, excavated by Gábrici in 1922. The layer contained a mix of different terracotta roof elements dating to the 6th century BC.⁷⁰

Fragments: 10 sima fragments: VIN 136-139, 166-169, 179, 181. 3 geison revetment fragments: VIN 144, 183, 184 (figure 4.1-13)

Description:

Sima:

The anthemion sima is decorated in relief showing a seven leaved palmette alternating with lotus flowers growing from a series of u-shaped volutes. The volutes have a large central disk with a painted star. Where the two curls of the volutes meet there is a small three leaved hanging palmette, at the junction between two volutes is a single hanging bud. The horizontal tile is not preserved.

Geison revetment:

Profile	Size	Painted decoration
Hawksbeak	Average: 89 mm (range: 88-90)	Alternating thick and thin Doric leaves in relief with painted centres in red and black
Top roll	22 (20-23)	Diagonal bands in red
Main plaque	Guilloche radius 48 mm	Double guilloche with five strands in black and white. The central strand is substantially wider and in white. The centre of the guilloche is a four petal rosette and at the junction between two guilloche bands is a three leaved palmette

Discussion: VIN 136-138, 166-169 and 179 are from a perforated lateral sima (figure 4.1-13). VIN 139 is associated with a sima from the gable as there is no evidence of perforations (figure 4.1-13.e). Of the three geison revetment fragments De Miro interprets the angle of 97 degrees between the top horizontal and main vertical plaques on VIN 183 as evidence that this fragment belongs to a lateral geison revetment, while VIN 144 and 184 (figure 4.1-13.j) have a 90 degree angle and are thus from the horizontal geison revetment.⁷¹ It should be noted that none of the geison revetment fragments have the horizontal plaque preserved and the angle measured on the top of the vertical plaque might not represent the whole.

In terms of style and size, there is considerable variety within this frieze G. The palmette of VIN 138 is smaller and has a rounded silhouette compared to VIN 179, which has a more triangular silhouette. The relief on VIN 179 and 167 is considerably shallower and the profile is straight compared to VIN 136-138, 166 and 168 which show a deeper, more rounded relief and a curved profile. There are also differences between the two lotus bud fragments from the perforated sima (VIN 136 and 169) in terms of the depth

⁶⁹ Lang 2010, p. 88.

⁷⁰ De Miro 1965, p. 64; Gábrici 1925, p. 440.

⁷¹ De Miro 1965, p. 65.

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Figure 4.1-13: Frieze G. (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo)

of relief, the position of the leaves at the base of the flower and the size of the bud. Such variations within sima fragments, especially the ones associated with the lateral sima, are considerable especially when compared to the perforated lateral sima of frieze F, where all fragments related to the same position in the frieze are of the same size, profile and decoration. Differences in size and design might be attributed to renovations made to an existing roof, as suggested by De Miro.⁷² Another possible explanation is that the fragments were grouped together by De Miro based on their overall stylistic similarities and provenance, but that at least some objects of frieze G might come from a separate roof. Since these fragments were discovered in a disturbed context the provenance would arguably support such a scenario. In the fill layer in which these objects were found there were a number of fragments from other roofs, too, including VIN 521 from frieze F and VIN 143 from frieze H.

Many of the fragments from the lateral sima (VIN 136-138, 166, 168) and the geison revetment (VIN 183, 184) have strong similarities to numerous fragments from Naxos. They are divided into three groups, series A to C, which are believed to belong to three successive roofs associated with building B which was in use until the 5th century.⁷³ The form and size of the relief as well as the details of the anthemion pattern of at least some of the fragments associated with frieze G seem identical with series B (VIN 136-138, 166); for this reason De Miro suggests that the objects of frieze G from Akragas are made with the same mould as the ones from series B and might in fact be produced in Naxos.⁷⁴

Dating: Last third of the 6th century BC.⁷⁵

Publications: Carratelli & Fiorentini 1992, pp. 82, 86, fig. 81, 86; De Miro 1965, pp. 64-70, tab. XXV-3, XXVI-1; Lang 2010, p. 89, tab. 1.5-6, AKRA 12; Wikander 1986, p. 32, fig. 7, no. 5.

4.1.13 FRIEZE H (DE MIRO)

Provenance: The fragment is likely from the extensive fill layer in the area to the South-East of temple B, excavated by Gábrici in 1922.⁷⁶

Fragments: 1 geison revetment fragment: VIN 143 (figure 4.1-14)

Description:

Profile	Size	Painted decoration
Main plaque	-	Unknown
Bottom roll 1	30 mm	Plain roll, painted decoration unknown
Bottom roll 2	36	Bead-and-reel in relief
Bottom roll 3 (soffit)	18	Plain roll, painted decoration unknown
Horizontal plaque	-	Unknown

Discussion: As discussed in section 2.2.1, the addition of the bead-and-reel decoration to the geison revetment is associated with the last developmental phase for Sicilian geison revetments. Lang also dates the fragment to this period which is at the end of the 6th century.⁷⁷ Nevertheless, there are some variations,

⁷² De Miro 1965, p. 69.

⁷³ Pelegatti & Lentini 2011, p. 392, fig. 2-6.

⁷⁴ De Miro 1965, p. 67.

⁷⁵ Lang 2010, p. 89.

⁷⁶ De Miro 1965, p. 71; Gábrici 1925, p. 440.

⁷⁷ Lang 2010, p. 90.

the first example of a bead-and-reel moulding on a geison revetment at Selinus is found on roof 22 and dated by Conti to the first quarter of the 6th century.⁷⁸ The closest parallel can be seen in a geison revetment from Naxos which is forms part of the anthemion roof associated with temple B.⁷⁹ Other fragments of this geison revetment and sima type are well represented in Akragas as well, namely by frieze G that shows strong similarities with the example from Naxos as well, which raises the possibility that VIN 143 belongs to the same roof as frieze G instead of being from a separate one.

Dating: Last third of 6th century BC.⁸⁰

Publications: De Miro 1965, pp. 71-72, tab. XXVII-3b; Lang 2010, p. 90, AKRA 17.

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Figure 4.1-14: Fragment associated with frieze H (VIN 143, Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.14 FRIEZE H1 (DE MIRO)

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Figure 4.1-15: Sima fragments from frieze H1 (VIN 140, VIN 141. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: The fragments are likely from the extensive fill layer in the area to the South-East of temple B, excavated by Gábrici in 1922.⁸¹

⁷⁸ Conti 2012, pp. 205-222, fig. 200, 202, 203.

⁷⁹ Ciurcina 1993, pp. 34-35, fig. 14.

⁸⁰ Lang 2010, p. 90.

⁸¹ De Miro 1965, p. 72; Gábrici 1925, p. 440.

Fragments: 2 sima fragments: VIN 140, 141 (figure 4.1-15)

Description:

Profile	Size	Painted decoration
Top roll	28 mm	Black horizontal blocks, possibly with vertical lines
Top fascia	32/50	Crossed meander in black with red blocks in between
Cyma	42/38	Ionic cymation in relief
Cavetto	-	Fragmentary remains of small red and black leaves

Discussion: The two fragments are very similar to each other, especially in regards to the presence of the Ionic cymation below the top fascia. This might be the reason De Miro published the objects as part of to the same frieze. However, there is also a size variation of the top fascia, which leads Lang in contrast to separating the two fragments into two different roofs.⁸² On closer inspection the profile of VIN 141 (figure 4.1-15.b) shows the presence of a horizontal scar on the back, close to the top of the fragment, which indicates that this fragment might be from a corner decrease at the gable. The presence of a red block set between the interlocking meanders on the top fascia of VIN 140 (figure 4.1-15) cannot be determined anymore, as this fragment is too small that the space is not preserved where this decorative element would have been placed. It is therefore possible to account for the differences mentioned and, in the absence of additional fragments, there is no reason why the two fragments should not be considered as belonging to the same roof.

The presence of an Ionic cymation on the sima is rare, but not unknown for Sicilian architectural terracottas. An equivalent is recognized in the raking sima fragments associated with building B at Naxos. These fragments have a single roll, small fascia decorated with a crossed meander and an Ionic cyma followed by a cavetto.⁸³ Three successive lateral anthemion simas are associated with the same structure and are dated from the end of the 6th until the 5th century but it is not certain which of the simas, series A-C, is actually associated with the raking sima fragments. The strong stylistic connections between both frieze G and frieze H1 with the anthemion roof of building B at Naxos are therefore pointing towards the possibility that some of the fragments from frieze G and frieze H1 might belong to the same roof.

More parallels also exist with the raking sima from temple B at Himera. There, the top fascia is completely replaced by the moulded Ionic cymation, and it is dated to 550-530 BC by Wikander⁸⁴ and the last third of the 6th century by Lang.⁸⁵ Both Lang and Wikander see the addition of Ionic elements to the canonical sima as part of the last phase of this roof type dating to between 550 and 480 BC.⁸⁶ The Himera example shows a more substantial departure from the canonical sima since the top roll is a moulded bead-and-reel and the top fascia has disappeared. In comparison frieze H1 retains many of the canonical elements, such as the double roll and fascia at the top. The less elaborate VIN 140 and 141 might therefore be considered slightly older than the example from Himera.

Dating: Last third of 6th century BC⁸⁷

⁸² Lang 2010, p. 87.

⁸³ Pelegatti & Lentini 2011, pp. 392-394, fig. 7.

⁸⁴ Wikander 1986, p. 37, fig. 9.

⁸⁵ Lang 2010, p. 100.

⁸⁶ Lang 2010, pp. 39-40; Wikander 1986, pp. 18-20; Winter 1993, p. 276.

⁸⁷ Lang 2010, p. 87.

Publications: De Miro 1965, p. 72, tab. XXVII-3c,d; Lang 2010, p. 87, tab. 1.1-2, AKRA 2-3.

4.1.15 FRIEZE I (DE MIRO)

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Figure 4.1-16: Sima fragments from frieze I. (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo)

Provenance: VIN 182 was found to the North of temple A. The museum number of the second fragment indicates this object is originally from the civic museum of Agrigento, more information about the find context is not available (VIN 616).

Fragments: 2 sima fragments: VIN 182, 616 (figure 4.1-16)

Description:

Profile	Size	Painted decoration
Top fascia	26 mm high	Plain fascia with slightly rounded top edge. Remains of black paint on front and top surfaces
Moulding 1	37 mm high	Inverted egg-and-dart cyma
Moulding 2	31 mm high	Squarish bead-and-reel
Fascia	-	Plain fascia

Discussion: VIN 616 has not been published before and has no information on provenance, but in terms of style and profile this fragment matches VIN 182 exactly, and the two objects are therefore placed in the same stylistic group.

The profile of the two fragments is not readily identifiable as architectural terracotta. De Miro considers VIN 182 to be a geison revetment fragment with stylistic comparisons to mainland Greece and Metapontium based on the large moulded cyma.⁸⁸ While Barletta follows this identification, she

⁸⁸ De Miro 1965, p. 73.

finds closer stylistic parallels with simas from Sardis based on stylistic similarities of the egg-and-dart in combination with the bead-and-reel.⁸⁹ Lang considers the fragments as architectural terracottas but does not identify the specific type.⁹⁰

When the profile of frieze I is examined the identification as a geison revetment fragment is cast in doubt. The top fascia is about 3 cm high and set at the back from the projecting cyma, in line with the bottom fascia. This fascia would therefore prevent the placement of a sima fragment on top. The top fascia can also not be interpreted as the start of a connected sima fascia similar to the combined sima and geison revetment fragments from Metapontium. The presence of paint at the top of this ridge indicates that the top edge is not a broken fracture.

In discussing the fragments' profile in 2012, Clemens Voigts suggested that this fragment might better be interpreted as part of a terracotta sarcophagus. Known terracotta sarcophagi from Akragas provide a number of stylistic comparisons, including the use of a squarish bead-and-reel,⁹¹ and a top ledge profile that includes a bead-and-reel as well as an egg-and-dart moulding.⁹² Furthermore, there are similarities with profiles from published terracotta sarcophagi from other Sicilian colonies, such as from the necropolis near Leopardi, Gela.⁹³ While the main body of the sarcophagus consists of a uniformly thick slab less than 4 cm thick, there is a moulded ledge at the top which supports the separately made lid. The back edge of this top ledge corresponds in size, shape and placement to the top fascia of the fragments of frieze I. Based on these close similarities in profile and decoration between frieze I and Sicilian terracotta sarcophagi, the identification of this fragment as architectural terracotta is thus in doubt.

The majority of previous researchers did not have access to the original fragment, relying instead on published information. The previous images are only of the front view from which the profile of the object is not readily discernible. The problematic identification of this fragment demonstrates the importance of profile images or drawings (figure 4.1-16).

Dating: Last third of 6th century BC⁹⁴

Publications: Barletta 1983, pp. 267-269, fig. 45; De Miro 1965, p. 73, tab. XXVIII-1; Lang 2010, p. 90, tab. 1.3, AKRA 19.

4.1.16 SIMA A

Provenance: From the excavations to the South of temple B by De Miro in 1958⁹⁵

Fragments: 1 sima fragment: VIN 225 (figure 4.1-17)

89 Barletta 1983, pp. 268-269.

90 Lang 2010, p. 90.

91 Agrigento Archaeological Museum Inv. no. C 1889 (Bonanno 1998, tab. 82).

92 Agrigento Archaeological Museum Inv. no. AG 8887 (Bonanno 1998, tab. 88).

93 Bonanno 1998, pp. 191-195, tab. 10.

94 Lang 2010, p. 90.

95 De Miro 1963, pp. 160-165.

Description:

Profile	Size	Painted decoration
Cavetto	-	Fragmentary remains consistent with standing leaves
Roll	25 mm	Alternating red and white blocks with one thin vertical line
Fascia	-	Possibly a meander

Discussion: While a photograph of this fragment is published by De Miro in the 1965 publication, it is not named or discussed. Instead, the information comes from one of his earlier publications, in 1963. Stylistically this object does not fit with any of the known groups based on the type and colour of the decoration. It is therefore placed in a functional category of its own. While this fragment is rather small the profile and decoration is consistent with a sima. As seen in frieze A and D the meander pattern is quite common for the architectural terracottas of Akragas and Sicily as a whole, but its placement on the lower fascia is normally only found on raking or horizontal simas. Examples of raking simas with a meander pattern include one from the temenos of the Athenaion at Gela⁹⁶ and revetment C from Selinus.⁹⁷

Dating: 570-530 BC⁹⁸

Publications: De Miro 1965, tab. XXIV-1e,f; De Miro 1963, p. 165, fig. 84c; Lang 2010, p. 88, AKRA 10.

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Figure 4.1-17: Sima A (VIN 225. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.17 SIMA B

Provenance: The museum number is in the middle of a range of numbers that are from Gábrici's excavation to the South-East of temple B and are most likely from the fill layer which contained numerous fragments of different architectural terracottas from the 6th century.⁹⁹

Fragments: 1 sima fragment: VIN 142 (figure 4.1-18)

⁹⁶ Lang 2010, p. 94, GELA2, tab. 4.3-4.

⁹⁷ Conti 2012, pp. 113-127, fig. 105, 108, 111.

⁹⁸ Lang 2010, p. 88.

⁹⁹ Gábrici 1925, p. 440.

Description:

Profile	Size	Painted decoration
Top roll 1	21 mm diameter	Unknown
Top roll 2	22	Unknown
Top fascia	-	Unknown

Discussion: While the painted decoration is barely visible on the top fascia, there appears to be at least one curved white line. Even though this is a deviation from the more conventional rectilinear patterns including a checkerboard or meander, it is not entirely unknown for the architectural terracottas of Sicily. A sima found by Orsi during his excavations in the via Minerva in Syracuse has a pattern consisting of alternating rosettes and blocks on the top fascia, for instance.¹⁰⁰

Dating: Unknown

Publications: Not published

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Figure 4.1-18: Sima B (VIN 142. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.18 SIMA C

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Figure 4.1-19: Sima C (VIN 279. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: From Marconi's excavation in the urban sanctuary in 1927.¹⁰¹

Fragments: 1 sima fragment: VIN 279 (figure 4.1-18)

¹⁰⁰ Lang 2010, pp. 337-338, taf. 33,1.

¹⁰¹ Marconi 1933, p. 39.

Description:

Profile	Size	Painted decoration
Top roll 1	20 mm diameter	Horizontal black and white blocks with three black lines
Top roll 2	21	Horizontal red and white blocks with three black lines
Top fascia	-	Unknown

Discussion: This fragment shows strong similarities in terms of its profile and decoration with frieze A and D.

Dating: Unknown, middle of the 6th century based on stylistic similarities with Frieze A and D

Publications: Marconi 1933, p. 39, fig. 15-2.

4.1.19 GEISON REVETMENT A

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Figure 4.1-20: Fragments from geison revetment A (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: The museum number indicates the three fragments originally came from the civic museum collection. VIN 350 and 611 both have a small white sticker similar to those found on VIN 352 (frieze B4, section 4.1.5) with the first three lines of text being an exact match. If these stickers can be associated with Marconi's excavations the objects might come from either the excavations at temple G or the urban sanctuary.

Fragments: 3 geison revetment fragments: VIN 350, 610, 611 (figure 4.1-20)

Description:

Profile	Size	Painted decoration
Main plaque	-	Double guilloche consisting of three strands in black, white and red/black. Central decoration is a black disk
Bottom roll 1	19 mm	Unknown
Bottom roll 2	15	Unknown
Horizontal plaque	78	Unknown

Discussion: The fragments have strong similarities in terms of the profile and painted decoration with frieze A and D. Unfortunately, the decorative elements are not preserved on VIN 350. In the museum of Agrigento the three fragments are stored in the same drawer with objects from frieze B1, B2, and B4.

Dating: middle of the 6th century based on stylistic similarities with Frieze A and D.

Publications: Unpublished

4.1.20 LION HEADED WATERSPOUT

Provenance: On the back of the fragment is a note indicating it is was found in 1959 in a cistern near temple A.

Fragments: 1 waterspout fragment: VIN 334 (figure 4.1-21)

Description: The fragment preserves the left-hand side of a lion's mane and ear. The mane is rendered as two rows of triangular, teeth like locks. The sculpted ear has a rounded point and sits at the beginning of the pate. A small portion of red painted relief remains on the main fascia to the left of the lion. While there is very little remaining decoration, this appears to be a leaf from a hanging palmette.

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Figure 4.1-21: Lion headed waterspout fragment (VIN 334. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Discussion: Only a handful of terracotta lion headed waterspouts are documented from Sicily from the Archaic period. Including this single fragment from Akragas there are only six in total. The other known examples are a fragment from temple A or B from Megara Hyblaea, three from Selinus,¹⁰² and one from Leontini.¹⁰³ The scarcity of lion headed waterspouts in Sicily as compared to the presence in mainland Greece is attributed to the preference for tubular waterspouts in the canonical Sicilian roof. The use of

¹⁰² Mertens-Horn 1988, pp. 183-184, taf. 18b.c, 19.a.b.c.

¹⁰³ Monterosso 2009, p. 433, fig. 13.

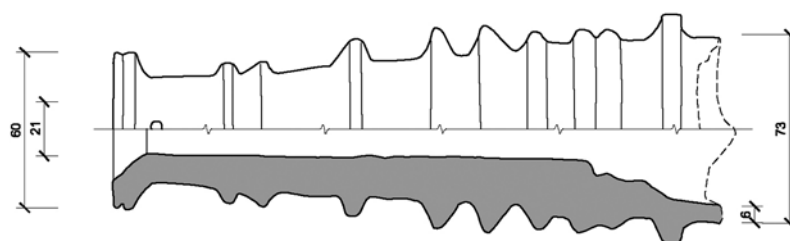
lion headed waterspouts is instead associated with the later anthemion sima in Sicily.¹⁰⁴ Mertens-Horn has some doubts regarding the complete form of VIN 334. She does not connect it to an anthemion sima, but instead proposes that the remains of the anthemion pattern in relief, seen on the side of the head, indicate it was in fact part of a continuous lion headed waterspout sima.¹⁰⁵

Due to the fragmentary condition, only the lion's mane and ear as well as the decoration of the main fascia can be used for stylistic comparisons. Three fragments of lion headed waterspouts from Selinus have three rows of long and straight, rectangular shaped locks with a rounded edge. They are all associated with the Selinuntine anthemion roofs of temple C, temple E1 and the roof formerly associated with temple Y respectively.¹⁰⁶ In terms of style, the closest parallel are the lion headed waterspouts from temple A at Akragas. These stone elements have similarly shaped hair and ears and are dated to the last quarter of the 6th century.

Dating: 520-500 BC¹⁰⁷

Publications: Mertens-Horn 1988, p. 184, tab. 19d.

4.1.21 TUBULAR WATERSPOUT



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3 cm

Figure 4.1-22: Waterspout (VIN 361. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: From Marconi's excavation in the urban sanctuary in 1927¹⁰⁸

Fragments: 1 waterspout fragment: VIN 361 (figure 4.1.-22)

Description: This 240 mm long waterspout consists of a simple rimmed opening and a long conical spout decorated with nine rings. Near the rim there are two small holes which were punched into the

104 Mertens-Horn 1988, pp. 79-80.

105 Mertens-Horn 1988, p. 84.

106 Mertens-Horn 1988, p. 183, taf. 18.b-c, 19.a-b.

107 Mertens-Horn 1988, p. 84.

108 Marconi 1933, p. 39.

clay while wet.

Discussion: Unlike most canonical Sicilian sima waterspouts, which have a disk shaped decoration located close to the mouth of the spout, this fragment has a plain opening. However, there are some examples of waterspouts without a disk, including ones from Selinus.¹⁰⁹ The length and the ring decoration on this waterspout are not very typical although an example of a long waterspout with a couple of rings is associated with a canonical roof, frieze B from Naxos, dated from 580-570 BC.¹¹⁰ It is possible, however, that this waterspout was not part of a terracotta roof.

Dating: Unknown

Publications: Marconi 1933, p. 40, fig. 16.

4.1.22 ANTEFIX A

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Figure 4.1-23: Antefix A (VIN 391. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: From the archaic layer at the Roman and Hellenistic quarter close to S. Nicola, excavated in 1964¹¹¹

Fragments: 1 antefix fragment: VIN 391 (figure 4.1-23)

Description: An extended semi-circular plaque with painted decoration. The curved cover tile was connected at the top edge of the plaque and terminates 30 mm from the bottom edge of the plaque. The painted decoration consists of a standing palmette with nine leaves growing from a double volute that encircles the entire palmette, forming a border. The outer border consists of small petals with a red outline, white line and alternating red and possibly black centre. Remains of black decoration on the right side of palmette.

Plaque height: 157 mm, width: 209 mm

¹⁰⁹ Conti 2012, pp. 248-249.

¹¹⁰ Lentini 1997, p. 131, fig. 8.

¹¹¹ De Miro 1965, p. 74.

Discussion: The fragment was published by De Miro in 1965, but not specifically identified as a type. Rounded cover tiles with a flat semi-circular antefix plaque are associated with the Laconian roof system of which examples dating to as early as the third quarter of the 7th century BC are known. While the profile of the Laconian antefix is similar, the use of palmette and volute in the painted decoration is rare.¹¹² Compared to moulded antefixes, this type of antefixes with painted decoration on a flat plaque is less common in Sicily. While similar objects are missing in the well-published collections for Selinus,¹¹³ a few examples from Sicily do exist. These include a number of fragments found by Orsi during his excavations at the Athenaion of Syracuse. The antefixes are slightly smaller (18 x 13,5 cm) and have a seven leaved palmette on a simple s-shaped double volute.¹¹⁴ Recent excavations at the ship sheds of Naxos uncovered a 11 x 15,9 cm antefix with a curved cover tile. The painted decoration is not visible and it is not clear if this antefix belongs to the ship shed buildings dated to the 5th century.¹¹⁵ An antefix found in the acropolis area of Gela is similar to the Syracuse example mentioned and dates to the second half of the 6th century.¹¹⁶ According to Winter this antefix type known from Gela, Megara Hyblaea, Syracuse, and Camerina can be dated to the second half of the 6th century.¹¹⁷

Dating: Second half of the 6th century until the beginning of the 5th century BC.

Publications: De Miro 1965, p. 74, tab. XXVIII-2a, fig. 3.

4.1.23 ANTEFIX B

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Figure 4.1-24: Antefix B. (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo)

112 Winter 1993, pp. 95, 96, 106-107, fig. 11.

113 Conti 2012.

114 Orsi 1918, p. 673, fig. 247.

115 Lentini et al. 2008, pp. 347, 351, fig. 44.

116 Panvini 1998, p. 31, Inv. 35940.

117 Winter 1993, p. 279.

Provenance: From excavations at the sanctuary on the hill of S. Nicola¹¹⁸

Fragments: 2 antefix fragments: VIN 384, 385 (figure 4.1-24)

Description: Two fragments of semi-circular antefixes with a flat plaque and rounded cover tile placed at the top of the plaque. The left corner of VIN 385 appears to be the bottom edge of the cover tile. For both fragments the cover tile sits perpendicular to the plaque but the painted decoration differs. VIN 384 has a palmette encircled by a single undecorated band, possibly part of a volute in red on a black background. VIN 385 has a border of rounded petals with a white outline and a centre alternating in red and black which sits on top of a white band, possibly part of the volute which encircles the palmette. Only the tip of a palmette leaf is preserved.

Radius of outside edge: 85 mm

Discussion: The fragments were published by De Miro in 1965, but not specifically identified as a type. While VIN 384 and 385 only preserve a portion of the respective antefix, it appears that there are slight differences in the size of the plaques, as well as differences in the painted decoration. While it is not unknown for a single roof to have different antefixes,¹¹⁹ it is not possible at this stage to determine if these two antefixes belong to the same roof or not.

There are strong similarities with the painted decoration of antefix A and VIN 385 but the differences in the size and profile as well as the find locations indicate that these two fragments are not from the same roof.

Dating: Second half of the 6th century until the beginning of the 5th century BC.

Publications: De Miro 1965, p. 75, tab. XXVIII-2c,d.

4.1.24 ANTEFIX C

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Figure 4.1-25: Antefix C (VIN 356. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

¹¹⁸ De Miro 1965, p. 75.

¹¹⁹ Lentini et al. 2008, p. 337, fig. 56.

Provenance: From Fiorentini's 1965 excavation at the extra-urban sanctuary at S. Anna. This object was found next to the eastern wall of the main structure.¹²⁰

Fragments: 1 antefix fragment: VIN 356 (figure 4.1-25)

Description: Most of the left side of the face of the gorgoneion except for the nose and forehead is preserved. While the top of the head is eroded, there is no indication of a diadem or border. The hair hangs down straight in rows of bead like locks. The large eyes are pronounced with exaggerated upper and lower lids. The ears are considerably smaller than the eyes and almost disappear in the hair.

Fragment height: 154 mm, width: 110 mm

Discussion: The overall rendering of the face appears exaggerated, the eyes are disproportionately large and folds in the face are overstated. These stylistic characteristics can be seen in two other groups of antefixes. One group comes from the area around S. Francesco Bisconti at Morgantina and is dated to the end of the 6th century.¹²¹ The second is from Gela and dated to the second half of 6th century.¹²²

Dating: Second half of 6th century BC

Publications: Fiorentini 1969, pp. 67-68, fig. XXXII-2c.

4.1.25 ANTEFIX D

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Figure 4.1-26: Antefix D (VIN 332. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: The museum number is in the middle of a range of numbers for known architectural terracottas from Marconi's 1929 excavation around temple A.

Fragments: 1 antefix fragment: VIN 332 (figure 4.1-26)

Description: A large part of the gorgoneion's face is preserved. The face is square with large ears. The hair is not well defined and is styled into a single row of spiral curls. The small eyes have pronounced upper

¹²⁰ Fiorentini 1969, p. 68.

¹²¹ These objects are on display at the local museum at Morgantina, a published reference has not yet been found.

¹²² Panvini 1998, p. 33; Castoldi 2006, p. 390.

and lower lids and are slanted upwards. The eyebrows follow the shape of the eyes. The relief is shallow. The protruding tongue covers the entire chin and the teeth are quite equal in size with no protruding canine teeth.

Plaque height: 159 mm, width: 178 mm

Discussion: There are no direct parallels found elsewhere in Sicily. The closest example is antefix type B from Selinus which is dated to the second quarter of the 5th century.¹²³ The shape of the eyes and nose as well as the shallow relief are similar, and pronounced canine teeth are also absent. The rendering of the hair on the Selinus antefix, however, is in well-defined waves with a diadem, while the Akragas example has ill-defined spiral curls. There are also comparisons between this object and antefix H from Akragas (4.1-29), which is dated slightly earlier, to the end of the 6th century. The dating for VIN 332 can thus cover a wider period.

Dating: End of the 6th until first half of the 5th century

Publications: Unpublished

4.1.26 ANTEFIX E

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Figure 4.1-27: Antefix E (VIN 348. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: Unknown, according to the museum information this is a sporadic find originally from the civic museum of Agrigento.

Fragments: 1 antefix fragment: VIN 348 (figure 4.1-27)

Description: Only the top half of the face is preserved. While the top of the head is partly damaged, there is no evidence of a diadem or a border. The face is moulded with the nose and eyes in prominent relief. Sharp incised lines are used to define the heavy eyelids and the grooves around the nose. The eyes are almond-shaped and turned up at the ends. The prominent eyebrow follows the shape of the eye. The hair is less defined and in shallow relief.

Fragment height: 112 mm, width: 137 mm

Discussion: There are similarities in the shape of the eyes and brow, the definition of the hair and the

¹²³ Conti 2012, pp. 287-291, 295.

depth of the relief with antefixes from Syracuse that are dated to the second half of the 6th century.¹²⁴

Dating: Second half of 6th century BC

Publications: Unpublished

4.1.27 ANTEFIX F

Provenance: From De Miro's 1958 excavation in the area to the South of temple B. The fragment was found between the main building and the large pool.¹²⁵

Fragments: 1 antefix fragment: VIN 162 (figure 4.1-28)

Description: Only three rows of tight spiral curls are preserved.

Fragment height: 93 mm

Discussion: The depiction of hair as spiral curls is known from gorgoneion antefixes from Syracuse and Megara Hyblaea from the middle through to the end of the 6th century.¹²⁶ At Morgantina, there are also examples of similar hair depictions on antefixes from the early 5th century.¹²⁷ De Miro dates VIN 162 to the 6th century BC.¹²⁸ But as the comparisons with objects from Morgantina show the date might extend into the 5th century.

Dating: Second half of 6th century until beginning of the 5th century BC

Publications: De Miro 1963, p. 185, fig. 99.

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Figure 4.1-28: Antefix F (VIN 162. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.28 ANTEFIX G

Provenance: From Marconi's 1927 excavation in the urban sanctuary¹²⁹

Fragments: 1 antefix fragment: VIN 362 (figure 4.1-29)

¹²⁴ Pelagatti 2006, p. 444, fig. 43.21a-b.

¹²⁵ De Miro 1963, p. 185.

¹²⁶ Pelagatti 2006, p. 446, fig. 43.24-28.

¹²⁷ Kenfield 1990, p. 270, fig. 44.d-e.

¹²⁸ De Miro 1963, p. 185.

¹²⁹ Marconi 1933, p. 40.

Description: Only the bottom right quarter of the gorgoneion's face is preserved. It shows a prominent nose and protruding canine teeth that overlap, the tongue is partly preserved. The cheeks are round and the moulded relief is quite deep.

Fragment height: 92 mm, width: 102 mm

Discussion: The grotesque features present on this fragment are thought to be characteristic of earlier gorgoneion depictions. A grotesque snaggletooth example is considered one of the earliest gorgoneion antefixes from Megara Hyblaea, but there are also similar ones from later in the century including an example from Syracuse which is dated to the end of 6th century.¹³⁰ Belson dates antefix G from Akragas to the second quarter of the 6th century.¹³¹ Based on the objects from Megara Hyblaea and Syracuse VIN 362 should rather be dated to the second half of the 6th century. While the first stone structures in the urban sanctuary are dated to middle of the 6th century it might be that this antefix was used on an earlier structure with a different construction, but the presence of early buildings is disputed (section 1.2) and the stylistic comparisons point towards a later date.

Dating: Second half of the 6th century BC

Publications: Belson 1981, p. 104; Darsow 1938, p. 13; Marconi 1933, p. 40, fig. 17.

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Figure 4.1-29: Antefix G (VIN 362. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.29 ANTEFIX H

Provenance: VIN 245 was found in 1953 during Griffo's excavation in the small sanctuary to the West of gate V,¹³² while VIN 246 is from the civic museum collection of Agrigento and, therefore, the provenance is not known.

Fragments: 2 antefix fragments: VIN 245, 246 (figure 4.1-30)

Description: The well-preserved antefixes depict a gorgoneion within a circular antefix plaque. The eyes are slanted upwards and the painted brows are lifted. The face is rounded with chubby cheeks and chin. The hair consists of a single row of spiral curls. This gorgoneion is bearded, which is depicted by a single row of spirals, smaller than the hair above. The mouth and tongue are relatively small and the teeth do not feature prominently.

130 Pelagatti 2006, pp. 434-444.

131 Belson 1981, p. 104.

132 Carratelli & Fiorentini 1992, p. 72; De Miro 2000, pp. 122, 253.

Complete height: 140 mm, complete width: 150 mm

Discussion: While VIN 246 is from an unknown context, it appears to come from the same mould as VIN 245 (figure 4.1-30). It seems that De Miro considers the two objects to be from the same context.¹³³ This type has a friendlier aspect as earlier examples from Akragas including antefix C and G. There are strong similarities with antefix D in terms of the rounded cheeks, the shape and size of the eyes, the depiction of the hair and the lack of prominent canine teeth. Antefix D does not have a beard, however, and the relief is shallower.

The facial features are close to a gorgoneion antefix from Gela, currently housed in the British Museum, London. The round cheeks, nose, and mouth and the absence of prominent canine teeth as well as the shape of the ears are all similar. The Gela antefix wears a *stephané* and circular earrings, it also has wings or hair protrusions at the bottom, which are absent from the Akragas antefix. Van Buren and Higgins date this Geloan example to the 5th century.¹³⁴ Other antefixes from Gela with a similar rounded face structure and friendlier countenance are dated to the end of the 6th century.¹³⁵ Antefixes from Syracuse with similar characteristics are also placed to the end of the 6th century.¹³⁶

Dating: Last quarter of 6th century BC¹³⁷

Publications: Carratelli & Fiorentini 1992, p. 72, fig. 58; De Miro 2000, pp. 122-123, 253, tab. CLVI-1.

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Figure 4.1-30: Antefix H (VIN 245. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

133 De Miro published an antefix in his catalogue which he states is similar to VIN 245 and has the same provenance. This antefix, no. 1560, has the museum number AG 349. VIN 246 has the museum number C 349. The 'C' denotes that the object comes from the civic museum, for which no provenance information is available. Based on the similarities in the numbers it is likely that De Miro is actually referring to VIN 246 (De Miro 2000, pp. 122, 253).

134 Higgins 1954, pp. 309-310, no. 1137; Van Buren 1923, p. 144, no. 36.

135 Panvini 1998, p. 44.

136 Pelagatti 2006, p. 444.

137 De Miro 2000, p. 253.

4.1.30 ANTEFIX I

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Figure 4.1-31: Antefix I (VIN 576. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: The unpublished fragment is located in the same drawer in the museum storage as VIN 574 and other objects from De Miro's 1958 and 1962 excavations in the area to the South of temple B and the urban sanctuary. While this fragment has no museum inventory number, on the back it is written that the object comes from the Western section, next to a South-Western wall.

Fragments: 1 antefix fragment: VIN 576 (figure 4.1-31)

Description: The small fragment is the top right edge of a gorgoneion antefix plaque. Three of the spiral curls and part of the brow are preserved.

Fragment height: 63 mm

Discussion: The radius of the outside edge indicates that the fragment belongs to an antefix with a curved cover tile. As with most of the known antefixes from Akragas already discussed, for example antefix D and H (4.1.25, 29) this object also have hair depicted as a single row of spiral curls.

Dating: Unknown

Publications: Unpublished

4.1.31 ANTEFIX J

Provenance: Found in a deposit to the North of temple A¹³⁸

Fragments: 1 antefix fragment: VIN 176 (figure 4.1-32)

Description: The object shows a high level of plasticity. The bearded face is turned slightly to the left, the heavy brows are furrowed and protrude slightly over the heavy eyelids. The nose is squashed with flaring nostrils. The mouth is partly covered by a full moustache that blends in with the slightly wavy beard. There is no separation between the hair and beard, instead appearing as a continuous element like a lion's mane. The bovine ears are placed at the edge of the plate, but only the right ear is visible due to the slight movement of the head. In the centre of the forehead there are traces of two horns. The base of the horns is surrounded by hair and indicates that they grew from a single, central spot on the forehead. The horns appear to be thin, curving up and away from the head, but are not preserved beyond the base. The curved cover tile was connected to the top curve of the face plaque.

Complete height: 230 mm, complete width: 184 mm

138 Pugliese Carratelli 1996, p. 705.

Discussion: Stylistically this antefix has many similarities to silen antefixes from Gela and Naxos. The ones from Naxos are dated to the early 5th century and have upright bovine ears, wavy hair and beard, and a furrowed forehead, but the execution of the relief is less detailed and has a higher degree of rigidity.¹³⁹ Silen antefixes from Gela show similarities in terms of the bulging eyes, the prominent frown and bulbous nose. The moulding presents a high level of plasticity and realism. These objects are dated to 470-460 BC.¹⁴⁰ The silen antefixes from Gela and Naxos all face straight ahead. According to Lulof the side view and increase in plasticity are associated with antefixes from the 4th and 3rd century BC.¹⁴¹ The dating of this object based on style is therefore likely to be later than the examples from Gela and Naxos. According to the museum information this object is dated to the end of the 5th century,¹⁴² which places it after Gela and Naxos. However, based on the high level of plasticity and the turn of the head it might be even later. The position of horns at the centre of the forehead is not present on the other silen antefixes from Sicily. Scholars have suggested that the male figure on VIN 176 is a local river god,¹⁴³ who is depicted as a human headed bull figure with a beard and horns on local coins from the beginning of the 5th century.¹⁴⁴

Dating: End of 5th century BC¹⁴⁵ or later

Publications: Carratelli & Fiorentini 1992, pp. 86-87, fig. 87; Pugliese Carratelli 1996, p. 705.

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Figure 4.1-32: Antefix J with bearded face with horns (VIN 176. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

139 Lentini et al. 2008, p. 329, fig. 39.

140 Panvini 1998, p. 50.

141 Higgins 1954, p. 370, no. 1363; Lulof 2007, pp. 43, 53-55, no. 51-54.

142 Pugliese Carratelli 1996, p. 705.

143 Carratelli & Fiorentini 1992, pp. 86-87.

144 Inv. 2758, Archaeological Museum of Agrigento.

145 Pugliese Carratelli 1996, p. 705.

4.1.32 ANTEFIX K

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Figure 4.1-33: Antefix K, fragment associated with unknown palmette group A (VIN 607. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: The unpublished fragment is part of a group of various ridge palmette fragments that might come from Marconi's excavation in the urban sanctuary. In his report Marconi mentions finding a large number of such fragments¹⁴⁶ and the museum number, which starts with an 'S' is associated with other known finds by Marconi from the urban sanctuary (VIN 363 and 365, sections 4.1.45, 46).

Fragments: 1 antefix fragment: VIN 607 (figure 4.1-33)

Description: Part of a volute consisting of a double strand, one larger than the other. The centre of the volute is a raised semi-sphere. A small portion of the horizontal tile is preserved where it connects to the top of the antefix plaque.

Discussion: VIN 607 is the only fragment of this type found at Akragas. The decoration appears to be on only one side and there is a pronounced top flange, which points to this fragment being part of an antefix, and not a ridge tile palmette. Similar examples are not known in Sicily and therefore interpreting this fragment based on the small preserved portion is problematic.

Dating: Unknown

Publications: Unpublished

4.1.33 ANTEFIX L

Provenance: Collected during the period of unscientific exploration before the 1920's. The antefix was bought by Lunsingh Scheurleer for his private collection in The Hague in 1921 from Arndt from Munich. In 1934 it moved to the Allard Pierson museum in Amsterdam.¹⁴⁷ In the museum documentation and early publications the provenance of this piece is given as Akragas, but the exact find location is not known.

Fragments: 1 antefix fragment: VIN 623 (figure 4.1-34)

Description: Almost fully preserved head of silen antefix except for chipping around the beard. The cover tile is not preserved. Overall, the decoration in relief is fairly shallow except for the protruding,

¹⁴⁶ Marconi 1933, p. 88.

¹⁴⁷ Lulof 2007, pp. vii, 19.

bulbous nose. Vertical lines indicate the hair and beard. The large almond-shaped eyes have shallow eyelids and are framed by large eyebrows which follow the shape of the eyes until they meet just above the bridge of the nose.

Complete plaque height: 215 mm, complete plaque width: 94 mm

Discussion: As exemplified by the roofs of the ship sheds from Naxos¹⁴⁸, Sicilian antefix roofs frequently combined silen and gorgoneion antefixes on the same roof (section 2.2.1.1). Unfortunately, this object comes from an unknown provenance and it is therefore not possible to determine which of the known gorgoneion antefixes might have accompanied VIN 623 on the same roof. The execution is similar to silen masks found in the large pool to the South of temple B.¹⁴⁹

Dating: Lulof dates this object to the first quarter of 5th century BC¹⁵⁰

Publications: Lulof 2007, p. 19, fig. 5c-d, pl. 5b-c; Van Buren 1923, p. 145, no. 41, fig. 6.3.

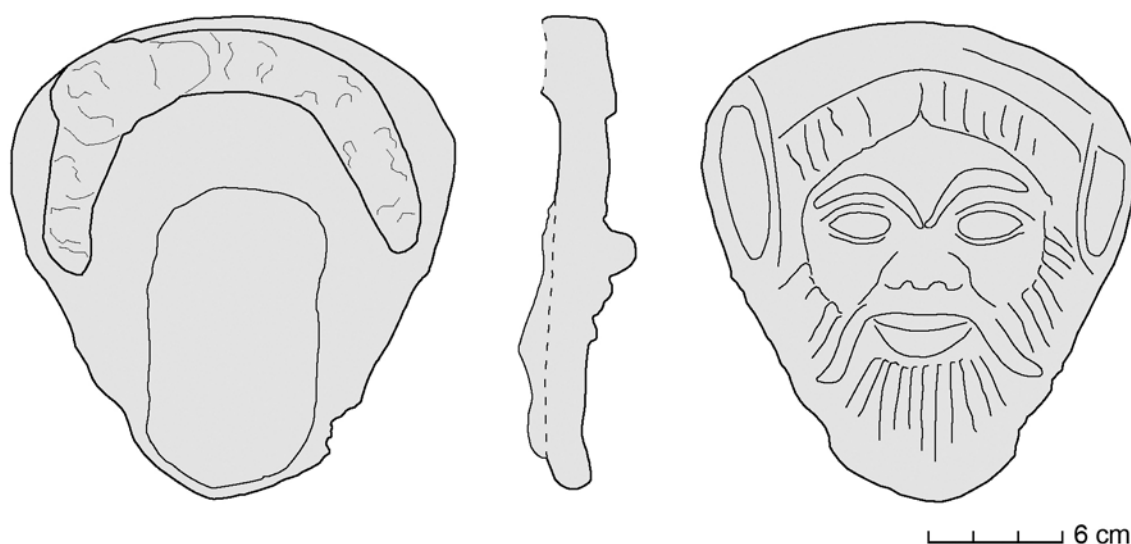


Figure 4.1-34: Antefix L (drawing after Lulof 2007, fig. 5c-d, pl. 5b-c) (VIN 623).

4.1.34 PLAQUE

Provenance: Found in 1953 during De Miro's excavation in the small sanctuary to the East of gate V¹⁵¹

Fragments: 1 plaque fragment: VIN 244 (figure 4.1-35)

Description: Only the top right quarter of the gorgoneion is preserved. The hair is depicted as a single row of spiral curls. The rounded eye has a pronounced upper lid and slants downwards. The pronounced eyebrow is slightly s-shaped.

Fragment height: 115 mm

Discussion: De Miro recorded the fragment as a gorgoneion antefix. Nevertheless, there is no evidence of a horizontal tile on the back of the object, which casts doubt on classifying it as an antefix.

148 Lentini et al. 2008.

149 De Miro 1963, p. 115, fig. 30.

150 Lulof 2007, p. 19.

151 De Miro 2000, pp. 122, 253.

Dating: Last quarter of 6th century BC¹⁵²

Publications: De Miro 2000, p. 253.

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Figure 4.1-35: Plaque (VIN 244. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.35 EAVES TILE A

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Figure 4.1-36: Eaves tile A (VIN 383. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: De Miro attributes this piece to an Archaic sanctuary in the area of S. Nicola¹⁵³

Fragments: 1 eaves tile fragment: VIN 383 (figure 4.1-36)

Description: The tile has painted decoration on the exposed front edge and along the main fascia. The decoration consists of multiple meanders and solid blocks of colour. On the main fascia, a running meander with two additional lines following the shape is visible. Two outlines at the top and bottom form

¹⁵² De Miro 2000, p. 253.

¹⁵³ De Miro 1965, p. 70.

a decorative band. On the reverse side, part of a painted figure and the Greek letter Alpha are preserved.
Fragment height: 140 mm, width: 175 mm, thickness: 36 mm

Discussion: De Miro described two different eaves tiles (VIN 383 and 197), but did not identify different types as well. In his text De Miro writes about evidence of deep chipping which he attributes to the fixing of additional elements after firing with the use of metal pins. Lang proposes that this indicates that the eaves tile was part of an anthemion roof which is why he dates VIN 383 to the last third of the 6th century.¹⁵⁴ The painted decoration is similar to that of painted eaves tiles from Syracuse found in excavations in the main square which are thought to date to the 6th century.¹⁵⁵ It should be noted that no anthemion sima fragments are known from the S. Nicola area and that the other anthemion simas from Akragas are formed as a single element. The pitting visible on the object today appears to be due to later damage, but there is modern restoration which might obscure additional evidence. The evidence would suggest that this element is part of an eaves tile instead of an anthemion sima.

Dating: Second half of the 6th century

Publications: De Miro 1965, pp. 70-71, tab. XXVII-2b; Lang 2010, p. 89, AKRA 13.

4.1.36 EAVES TILE B

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Figure 4.1-37: Eaves tile B (VIN 197. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: De Miro attributes this piece to an Archaic sanctuary in the area of S. Nicola¹⁵⁶

Fragments: 1 eaves tile fragment: VIN 197 (figure 4.1-37)

Description: The tile is decorated on one side with a block pattern consisting of black and white lines. The central block contains a rosette. The black paint is very faded. The outlines seen in figure 4.1-37 are lead pencil lines added in modern times. At the bottom edge is a bead-and-reel in relief. The front face is

154 De Miro 1965, p. 71; Lang 2010, p. 89.

155 Ciurcina 2006, pp. 393-394.

156 De Miro 1965, p. 70.

at an angle, decorated with a meander and staggered rectangular blocks of colour.

Fragment height: 108 mm, width: 167 mm, thickness: 36 mm

Discussion: De Miro described two different eaves tiles (VIN 383 and 197), but did not identify different types, see discussion in section 4.1.35. Decorated eaves tiles from Sicily are underrepresented in publications on architectural terracottas. Therefore, a close parallel to this object is currently not known. Nevertheless, it is also not certain that VIN 197 is actually an eaves tile; while De Miro published the object as such, Lang does not suggest a function.¹⁵⁷ There is one fragment (VIN 613, section 4.1.37) originally from the civic museum of Agrigento which has some similarities to this tile, predominantly the bead-and-reel, but it is much eroded.

Dating: Last third of 6th century BC¹⁵⁸

Publications: De Miro 1965, pp. 70-71, tab. XXVII-2a; Lang 2010, p. 89, AKRA 14.

4.1.37 BEAD-AND-REEL MOULDING

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Figure 4.1-38: Bead-and-reel fragments (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Grippo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: VIN 359 and 360 were excavated by Marconi in the area of the urban sanctuary.¹⁵⁹ According to the text written on the back of VIN 613 it was excavated in 1962 to the South of temple B.

Fragments: 3 fragments: VIN 359, 360, 613 (figure 4.1-38)

Discussion: VIN 359 and 360 are both half-round bead-and-reel rolls of around 45 mm in diameter. A small section of the vertical fascia on VIN 360 is preserved. This small section indicates that the bottom edge of the vertical plaque had a sloping edge similar to that of VIN 613. The bead-and-reel on the last one, however, is only 30 mm in diameter. Based on the size difference VIN 613 might therefore belong

¹⁵⁷ De Miro 1965, p. 71; Lang 2010, p. 89.

¹⁵⁸ Lang 2010, p. 89.

¹⁵⁹ Marconi 1933, p. 40, fig. 15-3.

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Figure 4.1-39: Acroterion, horse and rider fragments. (Copyright Regione Siciliana – Assessorato Reg.le dei BB. CC. e I. S. – Su concessione del Polo Regionale di Palermo per i Parchi e i Musei Archeologici– Museo Archeologico Regionale “Antonino Salinas” – divieto di duplicazione con qualsiasi mezzo)

to a different object. There are some parallels between these mouldings and eaves tile B in terms of the placement of the bead-and-reel at the bottom edge of a vertical plaque, but the three fragments are too small to allow for a clearer identification of the architectural type.

Bead-and-reel moulding diameter: 45 / 30 mm

Dating: Unknown

Publications: Marconi 1933, p. 40, fig. 15-3.

4.1.38 ACROTERION

Provenance: Most of the fragments were recently rediscovered in the storerooms of the archaeological museum in Palermo. The museum tags indicate that the objects are from Gábrici's 1922 excavation in the naiskos to the South-East of temple B. VIN 174 and 175 are stored in the archaeological museum in Agrigento; the information written on the fragments indicates they are from De Miro's 1962 excavation around temple B.

Fragments: 23 fragments: VIN 174, 175, 516-520, 522-536, 540 (figure 4.1-39)

Description: A large number of fragments is from the head of a horse. The mane falls to both sides of the head and is rendered as a series of beads roughly lined up in rows. Two smaller strands of beads fall between the horse's ears (VIN 174, figure 4.1-39.c). One fragment is from the horse's right leg and shows painted decoration with leaf patterns (VIN 524, figure 4.1-39.f). The rider is wearing pointed shoes (VIN 516 and 517, figure 4.1-39.d,g). The rider's hair flows around his shoulders in a series of bead like locks.

The size of the feet indicates this horse rider acroterion figure was close to life size.

Discussion: According to published reports there are two groups of horse rider fragments found by early excavators. Marconi mentions horse rider fragments found in the foundations of temple G¹⁶⁰ and Gábrici recalls a large quantity of figurative elements found to the South-East of temple B.¹⁶¹ Until the find in the archives of the museum of Palermo it was thought that both groups were lost.¹⁶² According to the museum tags, the group of recently rediscovered objects are from Gábrici's excavation. The two fragments found by De Miro to the South of temple B are similar to this group in style and size. Based on these similarities in style as well as on the find location the 23 objects from Gábrici's and De Miro's excavations are considered to belong to the same horse rider figure.

Fragments of horse and rider figures are known from Gela¹⁶³, Kamarina, Naxos, Selinus, and Syracuse. The ones from Naxos are thought to be from a number of equestrian figures depicting the whole horse, including the hooves, and are dated to the 6th century.¹⁶⁴ Other figures are noted to have been horse rider acroteria which were placed at the apex of the gable roof, as seen on the famous building model from Sabucina.¹⁶⁵ Examples of this type only depict the upper part of the horse, as seen in the acroteria from

¹⁶⁰ Marconi 1929, p. 158.

¹⁶¹ Gábrici 1925, p. 141.

¹⁶² Danner 1996, p. 89.

¹⁶³ According to Lentini & Pakkanen 2011, p. 421, the horse rider fragments from Gela are thought to be from a votive sculpture and are thus no acroteria.

¹⁶⁴ Lentini 2006, pp. 417-422.

¹⁶⁵ Danner 1996, pp. 101-102.

Kamarina, which is dated to the second quarter of the 6th century.¹⁶⁶ VIN 516 and 517 contain parts of the rider's left and right foot respectively. Both fragments have a finished horizontal edge just below the feet, indicating that this figure is an acroterion similar to the one from Kamarina.

The rider's pointed shoes are also found on an acroterion from Gela dated to the first half of the 6th century.¹⁶⁷ There is a very wide range seen in the depicting of the horse's mane. For example, the acroteria from Kamarina make use of incised wavy lines. In this regard, the 6th century horse rider fragments from Selinus have strong similarities with the fragments from Akragas based on the large rounded bead like hair roughly placed in rows and parted at the back of the horse's neck.¹⁶⁸

All the examples of similar objects from Sicily mentioned above date to the 6th century. Danner places the acroteria fragments from Akragas to the first half of the 6th century.¹⁶⁹ However, considering the beginning of monumental construction at Akragas (chapter 1) the dating is more likely to be towards the middle of the 6th century.

Dating: Middle of the 6th century BC

Publications: Danner 1996, pp. 89-90, fig. 18,1; Gábrici 1925, p. 441.

4.1.39 RIDGE TILE ANTEFIX A

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Figure 4.1-40: Ridge tile antefix A (VIN 180. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: Found by Gábrici in a fill layer to the South-East of temple B¹⁷⁰

Fragments: 1 ridge tile antefix fragment: VIN 180 (figure 4.1-40)

Description: Two petals with a raised outline in relief and a small bud in between. The top of the leaves forms the outside edge of the object. The scar left from the connection with the cover tile is set about 20 mm below the outside edge.

Fragment height: 106 mm, width: 140 mm

Discussion: The fragment is described by De Miro, but it is not identified as a type. The size as well as the

166 Ciurcina 2011, pp. 409-410, fig. 5; Danner 1996, pp. 86-87, fig. 22,1-3.

167 Danner 1996, pp. 80-85, fig. 20.1,5.

168 Danner 1996, p. 91, fig. 24.1,2.

169 Danner 1996, p. 89.

170 De Miro 1965, p. 75.

presence of a cover tile suggest that it is a ridge tile antefix. This fragment is similar to a ridge tile antefix from Naxos in terms of the size and decoration in relief. Danner dates the examples from Naxos to the first quarter of the 5th century.¹⁷¹

Dating: First quarter of the 5th century BC¹⁷²

Publications: Danner 1996, p. 19, tab. 5.3; De Miro 1965, p. 75, tab. XXIX-1c.

4.1.40 RIDGE TILE ANTEFIX B

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Figure 4.1-41: Ridge tile antefix B (VIN 226. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: Found in 1958 by De Miro in the top layers of the building to the South of temple B¹⁷³

Fragments: 1 ridge tile antefix fragment: VIN 226 (figure 4.1-41)

Description: Less than half of the left side of the gorgoneion's face is preserved. The hair is rendered as two rows of tight spirals. The eye is almond-shaped with pronounced lids. There are fine laugh lines incised at the corner of the eye. The eyebrow is rendered as a straight line in relief. The ear and eye are both slightly oversized. A round disk-shaped earring is preserved. The cheeks and overall shape of the face are rounded.

Fragment height: 405 mm, width: 185 mm

Discussion: While ridge tile antefixes with a moulded gorgoneion are known from a number of sites in Sicily, including Gela, Himera, and Selinus,¹⁷⁴ the closest parallels in terms of style are the antefixes from

171 Danner 1996, pp. 19-20, tab. 5.1.

172 Danner 1996, p. 19.

173 De Miro 1963, p. 181.

174 Danner. 1996, pp. 23-26.

Akragas. There, the hair is also rendered as spirals and no diadems or snakes are present (antefix D and H, sections 4.1.25, 29).

Dating: First quarter of 5th century BC¹⁷⁵

Publications: Danner 1996, p. 21, tab. 9.2; De Miro 1963, p. 191, fig. 96.

4.1.41 RIDGE TILE ANTEFIX C

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Figure 4.1-42: Ridge tile antefix C (VIN 392. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: According to the text on the back of the object it is a sporadic find from the Roman and Hellenistic quarter in 1964

Fragments: 1 ridge tile antefix fragment: VIN 392 (figure 4.1-42)

Description: The concave disk is painted with thin leaves alternating in red and black. The leaves have rounded edges and project beyond the ridge tile at the back. The back of the leaves are painted in a similar manner as the front.

Fragment height: 53 mm, width: 64 mm, outer edge radius: 185 mm

Discussion: The fragment is described by De Miro, but it is not identified as a type. According to Danner it is part of a disk-shaped ridge tile antefix with multiple zones of non-figurative decoration; he places the object to the 2nd quarter of the 6th century¹⁷⁶. Nevertheless, his dating is a little early according to what is known about monumental construction in Akragas (chapter 1). The scar where the cover tile connected to the plaque is only around 13 mm thick. The object thus seems slightly small for a ridge tile antefix.

Dating: Middle of the 6th century BC

Publications: Danner 1996, p. 13, tab. 2.2; De Miro 1965, p. 77. tab. XXVIII-2b.

4.1.42 GORGONEION A

Provenance: The object is from the collection of objects recently rediscovered in the archives of the museum of Palermo attributed to the 1922 excavation by Gábrici around the naiskos to the South-East of temple B.

Fragments: 1 fragment: VIN 542 (figure 4.1-43)

Description: Fragment of large gorgoneion plaque of which one serpentine curl, the back of the head, some internal supports and the flat back plate are preserved.

¹⁷⁵ Danner 1996, p. 21.

¹⁷⁶ Danner 1996, p. 13, tab. 2.2

Fragment height: 200 mm

Discussion: The back of the object is flat with no visible scars associated with a ridge tile. This indicates that it might be a pediment decoration and not a ridge tile antefix. While this is only a small portion of the original object it shows strong similarities with the large gorgoneion fragments from the pediment found on the acropolis of Gela and which are dated to the 6th century by Danner.¹⁷⁷

Dating: 6th century BC

Publications: Unpublished

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Figure 4.1-43: Gorgoneion A (VIN 542. Copyright Regione Siciliana – Assessorato Reg.le dei BB. CC. e I. S. – Su concessione del Polo Regionale di Palermo per i Parchi e i Musei Archeologici– Museo Archeologico Regionale “Antonino Salinas” – divieto di duplicazione con qualsiasi mezzo).

4.1.43 GORGONEION B

Provenance: The object is from the collection of objects recently rediscovered in the archives of the museum of Palermo attributed to the 1922 excavation by Gábrici around the naiskos to the South-East of temple B.

Fragments: 2 fragments: VIN 538, 539 (figure 4.1-44)

Description: Two small fragments with bead like hair in shallow relief known for gorgoneia. The hair is painted black and the plaque is about 35 mm thick. The outside edge on VIN 538 and the flat bottom edge on VIN 539 are preserved.

Discussion: Both fragments show similarities with a gorgoneion pediment plaque from Gela found inside temple B, which is dated to the second quarter of the 6th century by Danner.¹⁷⁸ But VIN 538 and 539 represent only a small part of the original object. It is possible that these fragments belong to a ridge

¹⁷⁷ Danner 2000, p. 30, fig. 9.

¹⁷⁸ Brea 1949-1951, p. 72, fig. 69; Danner 2000, p. 26, fig. 5.

tile antefix, too, similar to the one found East of temple F at Naxos.¹⁷⁹

Dating: Unknown

Publications: Unpublished

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Figure 4.1-44: Gorgoneion B (Copyright Regione Siciliana – Assessorato Reg.le dei BB. CC. e I. S. – Su concessione del Polo Regionale di Palermo per i Parchi e i Musei Archeologici– Museo Archeologico Regionale “Antonino Salinas” – divieto di duplicazione con qualsiasi mezzo).

4.1.44 PALMETTE A (DE MIRO)

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Figure 4.1-45: Palmette A (VIN 396. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico “Pietro Griffo” - divieto di duplicazione con qualsiasi mezzo).

Provenance: Unknown, museum number indicates object comes from the civic museum of Agrigento

Fragment: 1 fragment: VIN 396 (figure 4.1-45)

179 Danner 1996, p. 36, tab. 10-11.

Description: De Miro identified this object as palmette type 1.¹⁸⁰ The large fragment is mostly complete and consists of a nine leaved, rounded palmette growing from a double volute. The decoration is in very shallow relief except for the central eyes of the volute, which are raised. The palmette is decorated on both sides and has a hollow core. A small part of the connected ridge tile is preserved and the palmette sits parallel to it. Traces of red and black paint are still visible.

Complete height of palmette: 350 mm, complete width of palmette: 300 mm

Discussion: VIN 396 is distinct from other ridge tile palmettes from Akragas and Selinus in that the palmette has a round shape compared to the elongated shape of the other examples. In addition, the double volute consists of a single curl each, while others have of a s-shaped double curl. As De Miro noted there are similarities with palmettes from the Acropolis in Athens and one from Thermos¹⁸¹, but the closest comparisons might be found in the anthemion simas from Akragas (frieze F) and Selinus.¹⁸² The shape of the palmette is similar to ridge tile antefixes from the Geloan treasury in Olympia, except for the shallow relief.¹⁸³

Dating: Middle of the 6th century BC due to similarities with Geloan treasury

Publications: De Miro 1965, p. 76, tab. XXX-2a.

4.1.45 PALMETTE B (DE MIRO)

Provenance: Marconi and De Miro found a large number of these palmettes during excavations in the urban sanctuary in 1927 and 1953.¹⁸⁴ Two fragments also come from the sanctuary to the East of gate V from various excavations by Griffo in the 1950's (VIN 572, 587).

Fragments: 8 fragments: VIN 363, 367-9, 372, 373, 572, 587 (figure 4.1-46)

Description: A nine leaved palmette consisting of rounded leaves with swollen tips divided by sharp thin tipped leaves. One fragment (VIN 572) is painted red.

Discussion: De Miro identified VIN 372 and 373 as palmette type 2.¹⁸⁵ There are a number of fragments on display or in the storerooms of the archaeological museum at Agrigento which were discovered in the same area. Based on the similarities in find location and profile these fragments can therefore be added to this stylistic group palmette B. Only one of the fragments (VIN 572) shows evidence of being painted. Another identified by De Miro (VIN 373) appears to be smaller.

During excavations in the urban sanctuary and the sanctuary to the East of gate V, both Marconi and De Miro found numerous ridge tile acroteria consisting of a palmette on top of an s-shaped double volute. Both authors organized the fragments into different types based on the shape and size of the leaves. Neither attempted a reconstruction of the complete objects. The exception is group palmette D (section

180 In order to distinguish clearly between the established types presented in this chapter and the revised typology in chapter 5, stylistic types are ordered here by alphabetic letters, while numbers are used in chapter 5. For this reason, De Miro's type 1 is here listed as type A, type 2 as type B, etc.

181 De Miro 1965, p. 76.

182 Conti 2012, pp. 160-170, 194-203.

183 Heiden 1990, p. 100, tab. 68.1.

184 De Miro 2000, pp. 182, 234; De Miro 1965, p. 76; Marconi 1933, pp. 88, 96.

185 De Miro 1965, pp. 76, tab. XXIX-1d.

4.1.47) which is a well-preserved example with both palmette and volutes.¹⁸⁶ The association between the different types of palmettes and the different types of volutes is not clearly defined. De Miro does not place any of the known volute fragments with ridge palmette B, instead he groups all of them with palmette D, even though there are numerous stylistic differences.¹⁸⁷

Similar fragments were discovered by Marconi during his excavation of temple C at S. Biagio.¹⁸⁸ The current location of these fragments are not known, but they are likely housed in the regional archaeological museum in Syracuse, where a number of finds from the S. Biagio are part of the permanent display.

The shape of the palmette B has strong parallels to palmette fragments found over a wide area of Selinus and dated by Conti to the first half of the 5th century.¹⁸⁹ A similar palmette has also been located in Gela in the excavations around Molino di Pietro, which is dated by Orlandini to the 6th century.¹⁹⁰

Dating: 6th century until first half of 5th century BC¹⁹¹

Publications: De Miro 2000, pp. 182, 234, tab. CLVII-1b; De Miro 1965, p. 76, tab. XXIX-1d,e; Marconi 1933, pp. 40-41, fig. 19c.

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Figure 4.1-46: Palmette B (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

186 De Miro 1965, pp. tab. XXX-1.

187 De Miro 1965, pp. 76-77, tab. XXX-1; Marconi 1933, pp. 40-41, fig. 19.

188 Marconi 1926, p. 135, figs. 28-29.

189 Conti 2012, pp. 273-279.

190 Panvini 1998, p. 47.

191 De Miro 2000, pp. 182, 234.

4.1.46 PALMETTE C (DE MIRO)

Provenance: Marconi and De Miro found a large number of these palmettes during excavations in the urban sanctuary in 1927, 1932, and 1953.¹⁹² Some of the fragments are unpublished but according to museum documentation they come from excavations in the same locations (VIN 580, 581, 584, 588)

Fragments: 17 fragments: VIN 365, 370, 371, 378-81, 580, 581, 584, 588, 592, 596, 598, 600, 619, 620 (figure 4.1-47)

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Figure 4.1-47: Palmette C (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Description: The nine petals of the palmette have a wavy form, except for the longest central leaf which is straight. The leaves have a concave shape with raised borders and the decoration in relief is on both

192 De Miro 2000, pp. 182, 234; Marconi 1933, pp. 88, 96.

sides of the object.

Discussion: De Miro identifies two fragments directly as belonging to palmette group 3 (VIN 370, 371, figure 4.1-47).¹⁹³ Both of them have only portions of the palmette preserved with no volutes visible. Based on similarities in terms of style and find location a number of additional fragments are added now to this group. Like VIN 620, which shows a portion of the volutes. These are similar to VIN 382 and 388 which were published by De Miro as being part of palmette D (section 4.1.47). So far no other stylistic parallels have been found from Sicily.

Dating: Unknown

Publications: De Miro 2000, pp. 182, 253, tab. CLVII; De Miro 1965, p. 76, tab. XXIX-1a,b; Marconi 1933, pp. 40-41, fig. 19b, 62a.

4.1.47 PALMETTE D (DE MIRO)

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Figure 4.1-48: Palmette D (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Grippo" - divieto di duplicazione con qualsiasi mezzo).

193 De Miro 1965, pp. 76, tab. XXIX-a,b.

Provenance: VIN 387 was found near temple A,¹⁹⁴ and VIN 375 is possibly from Marconi's excavations at the urban sanctuary based on the museum number. Other unpublished fragments from excavations in the 1950's by De Miro in the sanctuary to the East of gate V come from museum storage (VIN 575, 577-579, 583, 585, 586, 589, 590)

Fragments: 27 fragments: VIN 366, 375-377, 382, 387, 388, 575, 577-579, 583, 585, 586, 589, 590, 594, 595, 597, 599, 601-603, 605, 606, 608, 609 (figure 4.1-48)

Description: De Miro included a number of volute fragments of different designs in this type. The most complete fragment (VIN 387) consists of a nine leaved palmette with rounded leaves with swollen tips divided by sharp thin tipped leaves sitting on a s-shaped double volute. The volute has a round central eye and the base of the palmette is arrow shaped with a raised central line. Some of the fragments (e.g. VIN 376 and 377) are similar to VIN 387 in that a simple s-shaped spiral with a shallow relief and a raised central eye form the volute. However, there is some variation; VIN 382 and 388 consist of a s-shaped volute where the main strand is accompanied by a much smaller secondary vine, which terminates in a lotus flower and acanthus leaf. VIN 577 and 589 are also smaller than VIN 376.

Discussion: De Miro placed VIN 375, 382, 387, 388, 577, and 590 in palmette group 4. The remaining fragments are largely unpublished and are placed in this group based on similarities in style and find location with the six fragments already identified. As already mentioned, the fragments in this group palmette D appear to belong to at least three different types based on the variations in size and decoration. VIN 387 is the most complete, containing at least the base of the palmette and the top half of the volutes. The full extent of half of the palmette is preserved and it is therefore the most informative piece regarding the overall design of this type. De Miro places VIN 375 in this group based on the strong stylistic similarities with VIN 387 even though it is significantly larger. For example, the diameter of the top volute for VIN 387 is 55 mm and for VIN 375 it is 70 mm.

Palmette group B is similar in design to VIN 387, but larger, it is therefore a possibility that at least some of the fragments within palmette group D might belong to the same type as objects currently in palmette group B.

The shape of the palmette itself has strong parallels to objects found over a wide area of Selinus and dated by Conti to the first half of the 5th century.¹⁹⁵ A similar palmette has also been found in Gela in the excavations around Molino di Pietro which is dated by Orlandini to the 6th century.¹⁹⁶ There is a very strong similarity in the style of these palmette fragments and VIN 387 except that this fragment is smaller in size.

The bottom edge of a number of fragments of various designs indicate a polygonal shaped ridge tile (VIN 376, 577, 609)

Dating: 5th century BC¹⁹⁷

Publications: De Miro 1965, p. 77, tab. XXVIII-3e, XXX-1, XXX-2b.

194 De Miro 1965, p. 77.

195 Conti 2012, pp. 273-279.

196 Panvini 1998, p. 47.

197 De Miro 1965, p. 77.

4.1.48 PALMETTE E

Provenance: From Marconi's excavations in the urban sanctuary in 1927¹⁹⁸

Fragment: 1 fragment: VIN 364 (figure 4.1-49)

Description: A single incomplete fragment of this type has been identified to date. It contains a partial palmette with isolated blade-shaped leaves with a raised central ridge. The overall palmette might have consisted of seven or nine leaves.

Discussion: While the palmette was published by Marconi, it was not included by De Miro in his 1965 publication. It can be identified as a ridge tile palmette or a lateral or central acroteria fragment based on similarities with known elements from Magna Graecia. The palmette shape is similar to central and lateral acroteria palmettes found at Caulonia. According to Barello they are typical for Magna Graecia during the second half of the 6th century.¹⁹⁹ Based on the small portion of the preserved tile it is not possible to determine conclusively if this fragment belongs to a ridge tile palmette or a central or lateral acroterion.

Dating: Second half of the 6th century BC

Publications: Marconi 1933, pp. 40-41, fig. 19d.

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Figure 4.1-49: Palmette E (VIN 364. (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.49 PALMETTE F

Provenance: The unpublished fragment is part of a large group of ridge palmette fragments that might come from Marconi's excavation in the urban sanctuary. In his report Marconi mentions finding a large number of such fragments,²⁰⁰ and the museum number, which starts with an 'S', is associated with other known finds by Marconi from the urban sanctuary (VIN 363, 365).

Fragment: 1 fragment: VIN 593 (figure 4.1-50).

Description: A volute with one preserved blade-shaped palmette leaf. The volute has raised edges.

Discussion: VIN 593 is the only fragment documented with a volute with raised edges. The blade-shaped

¹⁹⁸ Marconi 1933, p. 40.

¹⁹⁹ Barello 1995, pp. 77-78, tab. XLIII.

²⁰⁰ Marconi 1933, p. 88.

palmette leaf is also less common, the only other fragment with similarly shaped leaves is palmette E. It is not clear whether VIN 593 had moulded decoration on both sides.

Dating: Unknown

Publications: Unpublished

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Figure 4.1-50: Palmette F (VIN 593. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.50 PALMETTE G

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Figure 4.1-51: Palmette G (VIN 374. (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: From an excavation in the urban sanctuary in the 1950's or early 1960's²⁰¹

Fragment: 1 fragment: VIN 374 (figure 4.1-51)

Description: A small five leaved palmette on top of a double volute. The palmette leaves are in shallow relief with a small rounded border and painted in alternating black and red. The volute is in a shallow concave relief, too, with a central disk with a painted rosette. There is a complete void created between the bottom junction of the two volutes and a deeply recessed gap between the volute spiral and stem. The decoration is only on one side. The back of the object is flat.

Discussion: A single fragment of this palmette type is preserved with only the top part of the piece. The function of it is therefore indeterminable although it has strong similarities with the Archaic anthemion

²⁰¹ De Miro 1965, p. 77.

sima, frieze F (section 4.1.11). According to De Miro it shows further similarities to palmettes from Syracuse.²⁰²

Dating: Unknown

Publications: De Miro 1965, p. 77, tab. XXIX-1f.

4.1.51 RIDGE TILE A

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Figure 4.1-52: Ridge tile A (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: VIN 401 was found by Marconi inside temple B.²⁰³ VIN 397 is of unknown provenance, but the museum number starts with 'S', which is indicative for objects found by Marconi.

Fragments: 2 fragments: VIN 397, 401 (figure 4.1-52)

Description: The tile body is painted with crossed meanders in black and red. Where two meanders meet, there is a white square with two thin crossed lines. The bottom edge is decorated with alternating red and black dog-tooth pattern. The rim consists of a large flat band painted with a hooked meander in black and red. This band slopes upwards to the edge of the tile and is bordered on both sides with smaller rolls painted in red, white and black blocks. On one side of the tile is a semi-circular opening for a cover tile, this hole is 200 mm wide and 75 mm high.

²⁰² De Miro 1965, p. 77.

²⁰³ Marconi 1929, p. 154.

Complete length: 495 mm, complete height: 255 mm, thickness of main tile: 32 mm

Discussion: While VIN 397 has no provenance its similarities in painted decoration and size to VIN 401 support placing the two fragments in the same stylistic group.

VIN 401 is associated with the roof of temple B at Akragas. Recent scholarship suggests that while this building was started before the war in 480 BC, it was only completed afterwards.²⁰⁴ Dating the roof of temple B to the period directly after the war would correspond with the chronology suggested by Marconi for the ridge tile.

Dating: Second quarter of 5th century BC²⁰⁵

Publications: Marconi 1929, p. 154, fig. 85; Mertens 2006, p. 266.

4.1.52 RIDGE TILE B

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Figure 4.1-53: Ridge tile B (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: VIN 398 was found in the area of the L-shaped portico in the sanctuary to the East of gate V during excavations by De Miro between 1960 and 1970²⁰⁶

Fragments: 2 fragments: VIN 398, 399 (figure 4.1-53)

Description: The main body of the ridge tile is painted with a large crossed meander in black. The bottom

204 Barletta. 1997, p. 370.

205 Marconi 1929, p. 154.

206 De Miro 2000, p. 293.

edge consists of alternating black and red Doric leaves with a white outline. The tile is 35 mm thick but tapers down at the bottom edge.

Discussion: The painted decoration bears similarities to a ridge tile on display in the archaeological museum of Gela which was discovered in excavations in the Castellano cistern and dates to the 6th century according to the display information. A second ridge tile with comparable painted decoration was found by Brea in the area around the Athenaion of Gela.²⁰⁷ Ridge tile B also bears some resemblance to ridge tile A from Akragas, which is dated to the second quarter of the 5th century. Based on comparisons with objects from Gela and Akragas a date from the end of the 6th century until the first half of the 5th century is appropriate for ridge tile group B. This is slightly earlier than the date suggested by De Miro for VIN 398.²⁰⁸

Dating: End of 6th century until first half of 5th century BC

Publications: De Miro 2000, p. 293, tab. CLVII-4.

4.1.53 RIDGE TILE C

Provenance: VIN 389 was found in a cistern in the area to the South of temple B in 1958.²⁰⁹ VIN 553-555 are part of the collection of fragments rediscovered in the archives of the museum of Palermo. According to the museum tags these objects are from Gábrici's 1922 excavation of the naiskos to the South-East of temple B. VIN 563 was found in secondary use during the 2016 excavations at S. Anna.

Fragments: 6 fragments: VIN 389, 553-555, 563, 617 (figure 4.1-54,55)

Description: Ridge tile with a simple semi-circular ridge. No painted decoration is visible except for VIN 389 which has evidence of uniform red paint on the rim and main tile, and VIN 617 with solid black paint. On the inside, the rim has a single step to accommodate the next tile and at the bottom edge the rim is hollowed on the inside in order to taper to a point at the bottom edge.

Rim width: 110 mm, thickness of main tile: 30-38 mm

Discussion: Over ten fragments of this type were found with VIN 553-555 in the naiskos to the South-East of temple B. The profile matches that of the ridge tile VIN 563 found at S. Anna, which places all objects in the same stylistic group. The substantial distance between the two find locations, however, suggests that these fragments were not part of the same roof.

Undecorated roof tiles from Sicily are not well represented in archaeological studies and therefore comparable examples from outside Akragas are not known at this time.

VIN 617 is added to this group due to the similarities in profile, but unlike the other objects in the group, except VIN 389, it has painted decoration, consisting of a solid black across the preserved rim.

Dating: 6th or 5th century BC²¹⁰

Publications: De Miro 1963, p. 180, fig. 84bis-c.

207 Brea 1949, p. 66, fig. 59.

208 De Miro 2000, p. 293.

209 De Miro 1963, p. 180.

210 De Miro 1963, p. 180.

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Figure 4.1-54: Ridge tile C (VIN 389: Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo. VIN 553-554: Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Palermo per i Parchi e i Musei Archeologici- Museo Archeologico Regionale "Antonino Salinas" - divieto di duplicazione con qualsiasi mezzo).

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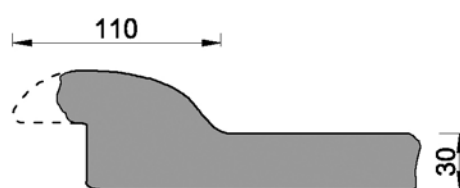


Figure 4.1-55: Side view and profile drawing for VIN 563 (measurements in mm) (Copyright Parco Archeologico e Paesaggistico Valle dei Templi di Agrigento).

4.1.54 RIDGE TILE D

Provenance: VIN 390 was found in a cistern to the South of temple B in 1958.²¹¹ VIN 618 is unpublished and without provenance, but the museum number falls within a range of objects known to be from Marconi's excavations around temple G. VIN 395 is a sporadic find from the Roman and Hellenistic quarter area.

²¹¹ De Miro 1963, p. 180.

Fragments: 3 fragments: VIN 390, 395, 618 (figure 4.1-56)

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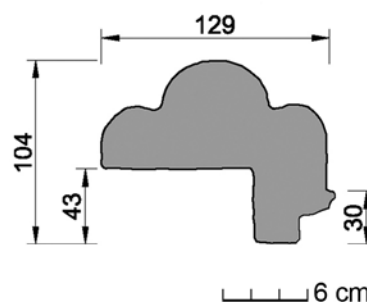


Figure 4.1-56: Side view and profile drawing for ridge tile D (Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Description: The rim consists of three semi-circular bands and varies in width between 120 and 130 mm. The central band is larger than the adjacent two. The painted decoration shows alternating black and red chevrons on a white background. On VIN 395 and 390 the chevron extends over all three bands; on VIN 618 it is only present on the central band, on the smaller bands the chevron is extended with a diagonal band of the same colour and thickness, but slanting in the opposite direction.

Rim width: 120-130 mm, thickness of main tile: ca. 30 mm (based on fracture on VIN 618)

Discussion: VIN 395 is fragmentary, but the presence of a large fracture on the right edge of the border suggests the presence of a third band, similar to the VIN 390 and 618. The profile and painted decoration of all three objects show strong similarities. The different find locations, however, indicate that they were part of different roofs.

The profile is similar to examples of type 1 from Selinus which Conti dates to the early 5th century, but these objects might be from the late 6th as well.²¹² A comparable piece was also found by Brea in his

²¹² Conti 2012, pp. 264-268.

excavations around the Athenaion of Gela.²¹³

Dating: 6th to 5th century BC²¹⁴

Publications: Unpublished

4.1.55 RIDGE TILE E

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Figure 4.1-57: Ridge tile E (VIN 222. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Provenance: The museum number falls within a range of objects from the 1962 excavations to the South of temple B.

Fragments: 1 fragment: VIN 222 (figure 4.1-57)

Description: The edge of the ridge tile has a raised rim consisting of two semi-spherical bands, the outer one being 96 mm wide, the inner band is 48 mm wide. The fracture of the main tile itself indicates a tile thickness of 24 mm. The painted decoration consists of alternating black, red, and white chevrons on the larger band, with slanted lines on the smaller bands that do not correspond directly to the placement of the adjacent chevrons.

Discussion: The profile is similar, if slightly larger, to examples of type 4 from Selinus which Conti dates to the 5th century based on the fabric type.²¹⁵

Dating: 5th century BC

Publications: Unpublished

²¹³ Brea 1949, p. 65, fig. 58-b.

²¹⁴ De Miro 1963, p. 180.

²¹⁵ Conti 2012, pp. 266-268.

4.1.56 RIDGE TILE F

Provenance: Found in the large pool to the South of temple B in 1958²¹⁶

Fragments: 1 fragment: VIN 223 (figure 4.1-58)

Description: The edge of the tile consists of a raised rim of three rounded bands. The central band is 26 mm wide while the two bands on either side are 50 mm wide. There is no evidence of painted decoration.

Rim width: 126 mm, thickness of main tile: ca. 28 mm (based on fracture)

Discussion: Undecorated roof tiles from Sicily are not well represented in archaeological studies and therefore comparable examples from outside Akragas are not known at this time.

Dating: 6th century BC²¹⁷

Publications: De Miro 1963, p. 166, fig. 84bis-a; De Miro 2000, p. 151.

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Figure 4.1-58: Ridge Tile F (VIN 223. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.57 RIDGE TILE G

Provenance: The museum number falls within a range of objects that is associated with a fill layer around the naiskos to the South-East of temple B excavated by Gábrici.

Fragment: 1 fragment: VIN 386 (figure 4.1-59)

Description: The rim consists of three rounded bands. The outer band is 21 mm wide and painted black. The central band is 56 mm wide and painted white. The third band is broken away, but there is evidence that it was also painted black.

Reconstructed rim width: ca. 100 mm

Discussion: The majority of ridge tile fragments already discussed has a rim that exceeds 100 mm in width. The reconstructed width of VIN 386 is slightly smaller. The shape of the profile is similar to ridge tile D, and by extension, to the same objects from Selinus and Gela which are dated to the late 6th and early 5th century.

Dating: Unknown

Publications: Unpublished

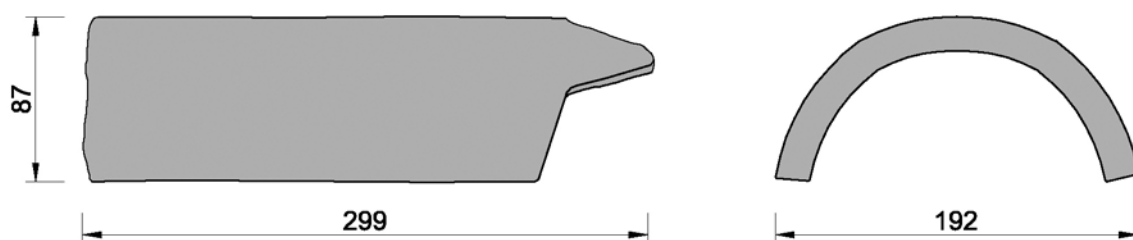
²¹⁶ De Miro 2000, p. 151.

²¹⁷ De Miro 1963, p. 166.

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Figure 4.1-59: Ridge tile G (VIN 386. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.1.58 RIDGE TILE H



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Figure 4.1-60: Drawings and photographs of ridge tile H (VIN 571, measurements in mm. Copyright Parco Archeologico e Paesaggistico Valle dei Templi di Agrigento).

Provenance: Found in secondary use, covering a votive deposit, during the 2016 excavations at S. Anna

Fragment: 1 fragment: VIN 571 (figure 4.1-60)

Description: The tile is 192 mm wide and has two openings for cover tiles on the opposing long sides. On one side is a pentagonal-shaped hole that fits Corinthian style cover tiles similar to cover tile A (section 4.1.59). On the opposing side is a semi-circular hole for a curved cover tile.

Fragment width: 192 mm, thickness of tile body: 18 mm

Discussion: The overall dimensions of the tile are consistent with cover tiles from Selinus dating to the 5th

century.²¹⁸ In comparison to the ridge tiles A-G from Akragas described above VIN 571 is substantially smaller. But the presence of openings on the sides to allow placing of cover tiles indicates that this tile functioned as a ridge tile, not a cover tile. In addition, the two openings show that the roof incorporated cover tiles of both the Corinthian and Laconian types, as seen in a 5th century roof at Selinus.²¹⁹

Dating: Unknown

Publications: Unpublished

4.1.59 COVER TILE A

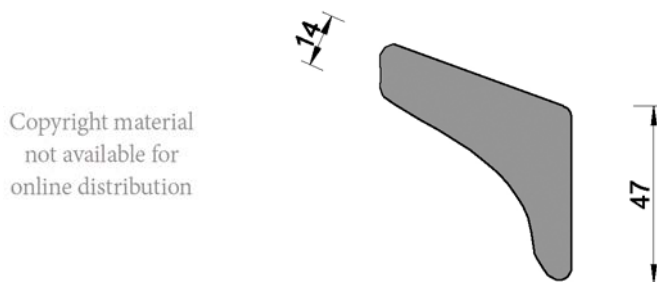


Figure 4.1-61: Photograph and drawing of profile of cover tile A (VIN 568, measurements in mm. Copyright Parco Archeologico e Paesaggistico Valle dei Templi di Agrigento).

Provenance: Found in secondary use during 2016 excavations at S. Anna

Fragment: 1 fragment: VIN 568 (figure 4.1-61)

Description: The bottom segment of the polygonal-shaped cover tile is 47 mm high. The main tile is 14 mm thick.

Discussion: Sicilian roof tiles are generally considered as a combination of flat pan tiles and curved, Laconian style, cover tiles.²²⁰ However, recent excavations in Selinus have also uncovered the presence of polygonal-shaped cover tiles of the Corinthian type, which are dating from the classical period.²²¹

Dating: Unknown

Publications: Unpublished

4.1.60 COVER TILE B

Provenance: Found in secondary use during 2016 excavations at S. Anna

Fragments: 3 fragments: VIN 427, 564, 565 (figure 4.1-62)

Description: 18 mm thick curved cover tile with a square bottom edge. The outside curved edge has a slight, irregularly shaped upstand.

Discussion: Only fragments of this cover tile type have been found in secondary use and as such it is not possible to provide the complete dimensions. The estimated reconstruction is based on the largest

²¹⁸ Jonasch 2009, p. 4.

²¹⁹ Jonasch 2009, pp. 3-4.

²²⁰ Winter 1993, p. 273.

²²¹ Jonasch 2009, p. 4.

available fragment. Cover tiles of this type are known to have tapered down to one end in order to facilitate overlap, so the dimensions in figure 4.1-62 were not constant over the entire length of the tile.

Dating: Unknown

Publications: Unpublished

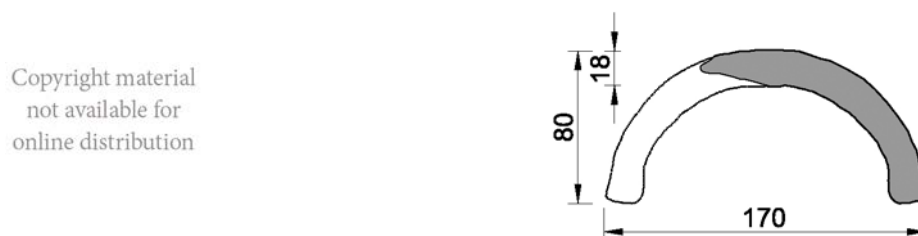


Figure 4.1-62: Cover tile B, top view of fragments and reconstruction of the profile (VIN 564, measurements in mm. Copyright Parco Archeologico e Paesaggistico Valle dei Templi di Agrigento).

4.1.61 COVER TILE C

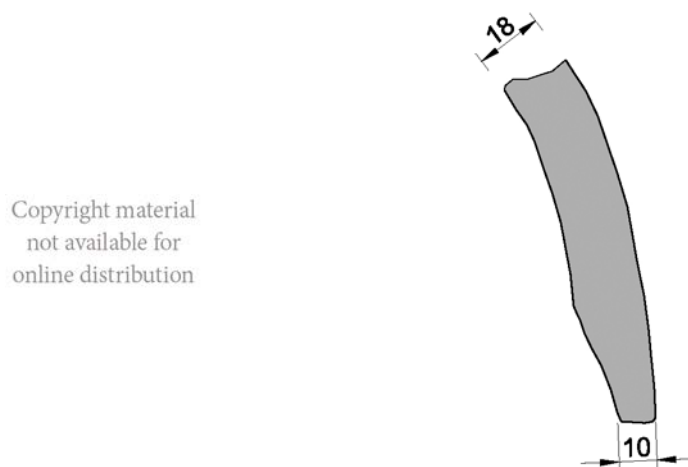


Figure 4.1-63: Side view and profile drawing of cover tile C (VIN 435, measurements in mm. Copyright Parco Archeologico e Paesaggistico Valle dei Templi di Agrigento).

Provenance: Found in secondary use during excavation at S. Anna in 2014

Fragments: 1 fragment: VIN 435 (figure 4.1-63)

Description: The curved cover tile is 18 mm thick, but at the bottom edge it tapers down to 10 mm.

Discussion: This isolated fragment is too small to allow for a full reconstruction. Based on the tapered bottom edge it is grouped separately from cover tile B.

Dating: Unknown

Publications: Unpublished

4.1.62 PAN TILE A

Provenance: Found in secondary use during excavation at S. Anna in 2014

Fragments: 6 fragments: VIN 421, 422, 425, 428, 436, 437 (figure 4.1-64)

Description: Pan tiles with a rounded side ridge that is around 50 mm high and 60 mm wide. The tile itself is around 30 mm thick.

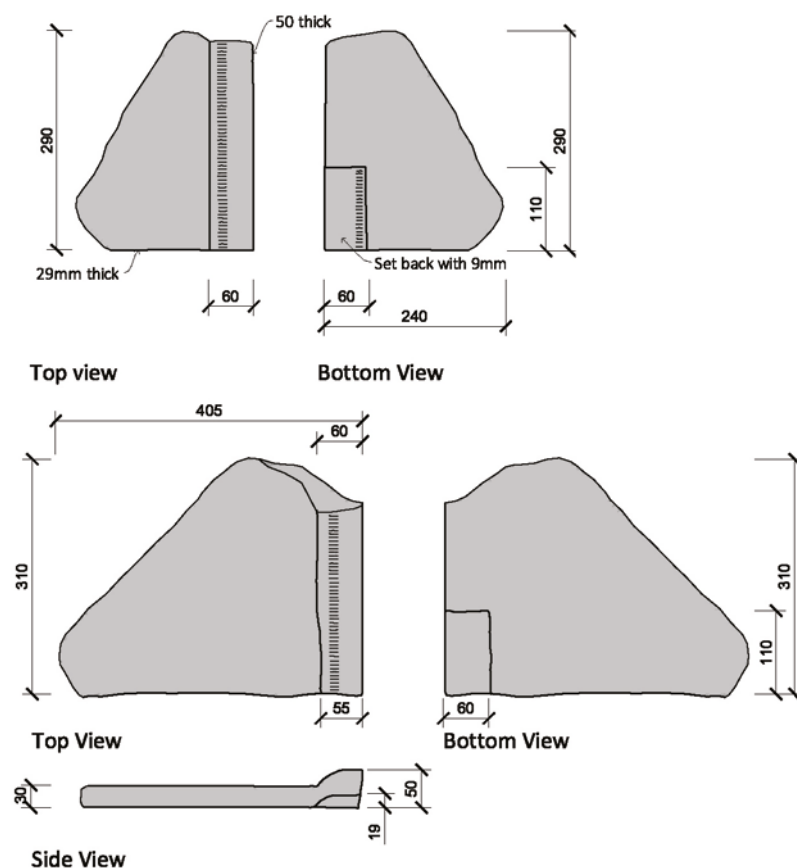


Figure 4.1-64: Pan tile A fragments (a: VIN 421, b: VIN 437, measurements in mm)

Discussion: The roof tiles found during the S. Anna excavations were all in secondary use. The fragments are therefore from a disturbed context and to date it has not yet been possible to reconstruct a complete pan tile. The identification of types has to rely on diagnostic characteristics of raised edges and notches. The key concern in organizing the fragments into groups is the size of the allowable variations in dimensions for each group. The notches formed at the bottom corners of the tiles correspond exactly to the size of the underlying tile's side ridge. Where the ridge is 60 mm wide, the notch made to fit on top of it is of an equal size. The only variation are VIN 425 and 437 where the side ridge tapers down to 55 mm at the ends. The depth of the bottom notch is also equal to the height by which the side ridge rises above the main tile, which is 20 mm. This indicates that there is a very small tolerance for dimensional variations in pan tiles.

Published studies on Greek roof tiles normally only provide the absolute overall dimensions and make no mention of size variations between individual tiles.²²² One exception is the work by Philip Sapirstein

²²² Glendinning 1996; Jonasch 2009.

on the 7th century roof tiles from Corinth. He found that while the thicknesses of tiles vary considerably the top and bottom profiles, where adjacent tiles have to connect, are very consistent.²²³ For this reason, VIN 428 is also added to group A, for while the height of the side ridge is 56 mm and the thickness of the pan tile is 36 mm; the width of the side ridge is the same as for the rest of the group. In her analysis of roof tile types from Selinus Conti combines objects primarily on the shape of the profile; as a result the particular dimensions of elements such as the side ridges can differ considerably within objects of the same category, i.e. tiles of the same type might vary by as much as 3 cm at the side ridges.²²⁴

The profile of pan tile A has similarities to Conti's type 11 and 12, but the side ridge is slightly narrower, at 60 mm instead of 65-70 mm as seen in the tiles from Selinus. Conti dates these types to the second half of the 5th century to the 4th century.²²⁵ A similar profile is also found at Himera, but the excavators do not provide chronological information.²²⁶

Dating: 5th to 4th century BC

Publications: Unpublished

4.1.63 PAN TILE B

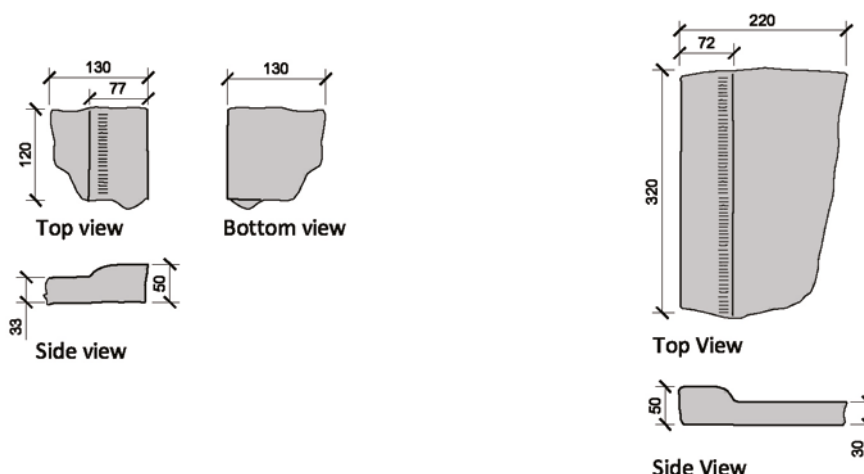


Figure 4.1-65: Pan tile B fragments (a: VIN 424, b: VIN 430, measurements in mm).

Provenance: Found in secondary use during excavation at S. Anna in 2014

Fragments: 3 fragments: VIN 423, 424, 430 (figure 4.1-65)

Description: Pan tile with slightly flattened side ridge. Ridge is around 50 mm high and more than 70 mm wide. The tile itself is more than 30 mm thick.

Discussion: The group B of pan tiles is distinguished from pan tile A by the side ridge being more than 10 mm wider. As discussed above (section 4.1.62), such a large variation in the dimension of interlocking elements would be highly problematic and thus indicates that these pan tiles were not part of the same roof as the ones of group A. As it is, VIN 424 has a side ridge of 77 mm wide, which is 7 mm wider than

223 Sapirstein 2009, p. 205.

224 Conti 1998, p. 221.

225 Conti 1998, p. 224, tab. II.14, III.15-17.

226 Tullio 1976, pp. 441-442, fig. 12.5.

VIN 423. This might indicate that the two tiles are from different roofs, too.

Similar profiles are known from Selinus where it was in widespread use from the 5th to the 4th century, and is classified by Conti as type 10.²²⁷

Dating: 5th to 4th century BC

Publications: Unpublished

4.1.64 PAN TILE C

Provenance: Found in secondary use during excavation at S. Anna in 2014

Fragments: 1 fragment: VIN 429 (figure 4.1-66)

Description: Side ridge is very wide, 100 mm, and rather shallow, less than 50 mm high. The tile itself is less than 25 mm thick.

Discussion: The pan tile profile is similar to type 7 from Selinus as identified by Conti. This tile is used throughout the 5th century.²²⁸

Dating: 5th century BC

Publications: Unpublished

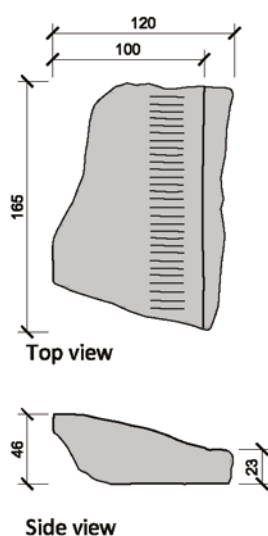


Figure 4.1-66: Pan tile C fragment (VIN 429, measurements in mm).

4.1.65 PAN TILE D

Provenance: According to the museum tags the fragment comes from Gábrici's 1922 excavation in the area around temple B

Fragments: 1 fragment: VIN 544 (figure 4.1-67)

Description: Raised edge of 60 mm wide and 50 mm high.

Discussion: In profile and size this fragment is similar to pan tile group A, but since it is from a different

²²⁷ Conti 1998, p. 223, tab. II.12.13; Jonasch 2009, p. 3.

²²⁸ Conti 1998, p. 221, tab. II.8.

location and the object is too fragmentary preserved, it is placed separately. VIN 544 is the bottom left corner of a pan tile with the notch on the underside in order to accommodate the tile when placed on the roof. On the inside of the notch there is a character in relief, most likely formed in the mould. The character appears to be the Greek Heta or Phoenician Heth.

Dating: 5th to 4th century BC

Publications: Unpublished

Copyright material
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online distribution

Figure 4.1-67: Pan tile D fragment, top view, underside and profile (VIN 544. Copyright Parco Archeologico e Paesaggistico Valle dei Templi di Agrigento).

4.1.66 UNKNOWN PAN TILE

Provenance: Found in secondary use during excavation at S. Anna in 2014

Fragment: 1 fragment: VIN 434 (figure 4.1-68)

Description: The 115 x 100 mm fragment has no preserved edges.

Discussion: This fragment is presumed to be a pan tile due to the flat profile and thickness. On one side there is a mark resembling a Greek Iota that was pressed into the clay while still wet.

Dating: Unknown

Publications: Unpublished

Copyright material
not available for
online distribution

Figure 4.1-68: Pan tile fragment of unknown type (VIN 434. Copyright Parco Archeologico e Paesaggistico Valle dei Templi di Agrigento).

CONCLUSION

The stylistic typology of architectural terracottas from Akragas is based on the published one by De Miro from 1965. Since then the amount of material has increased from 85 fragments to 265 objects and, therefore, the original typology had to be expanded considerably, especially in regards to antefixes, ridge tiles, and undecorated roof tiles. During this process a number of concerns have been identified in regards to the original typology by De Miro. For instance, frieze I (section 4.1.15) is identified as an architectural terracotta in his typology. While it does show some similarities to material from Metapontium, the overall dimensions and the profile are closer to that of terracotta sarcophagi from Akragas. The first identification of the objects in frieze I as architectural terracottas is thus in doubt. Another example are palmette group B, C, and D (sections 4.1.45-47), which follow De Miro's palmette group 2, 3, and 4. The previously unpublished fragment VIN 620 shows portions of both the palmette and volutes preserved. The shape of this palmette is the same as in VIN 371, which is assigned to palmette group C, but the volutes of VIN 620 are similar to objects in palmette group D (VIN 382, 388). It therefore appears that fragments that belong to the same type are split among different groups by De Miro. Such concerns raised about the original 1965 typology are based on the stylistic analysis of section 4.1. Differences in fabric and material composition also need to be taken into consideration in the following (section 4.2 and 4.3). Chapter 5 provides a completely revised typology for the material from Akragas based on the results of the different analytical endeavours in sections 4.1-4.3.

In terms of style, the material from Akragas represents the major terracotta roof types known in Sicily

from the 6th and 5th centuries BC (section 2.2.1.1). This includes the canonical Sicilian sima (e.g. frieze A, B3, and D), the anthemion sima type (e.g. frieze F and G) and the antefix roofs (e.g. antefix A, B, and H). There are more antefixes than previously indicated by the published record. Unfortunately, the majority of these antefix types are represented by a single object and, in some cases, only by a small fragment which cannot be assigned to specific type due to a lack of more information. Antefix roofs in Sicily are known to have consisted of antefixes of different types, with the combination of gorgoneion and silen being particularly popular (section 2.2.1.1). A number of gorgoneion antefix types have been identified (e.g. antefix C, D, E, F, G, H, and I) and two silen antefix types (antefix J and L). However, based on the find location information and stylistic aspects it is not possible to determine if any of the gorgoneion and silen types belonged to the same roof. When compared to other gorgoneion antefixes from Sicilian sites, the antefixes from Akragas appear to have some stylistic markers which appear to be particular to the city itself. None of the preserved fragments seems to wear any form of headdress or diadem.²²⁹ There is also no evidence of snakes in the hair.²³⁰

The stylistic influence of other Sicilian cities on the canonical Sicilian simas from Akragas appears to be more diverse than previously thought. De Miro considered the architectural terracottas from Gela to have the main stylistic impact.²³¹ While frieze A, B3, and D show similarities with Geloan roofs including frieze B and C,²³² there are strong similarities with roofs from Selinus²³³ and Syracuse as well.²³⁴ The use of a bottom roll on the sima profile seems to be present with greater frequency on objects from Akragas than at other cities. While bottom rolls appear on a roof from Selinus already mentioned, these are dated slightly later to the last third of the 6th century BC. For the anthemion sima roofs there are strong stylistic parallels between frieze F from Akragas with anthemion roofs from Selinus, and between frieze G and H1 from Akragas with the ones from Naxos.

In conclusion, the use of a bottom roll on the canonical Sicilian sima profile and the lack of a diadem or snakes on gorgoneion antefixes represent characteristics of the terracotta roofs from Akragas. While the architectural terracottas of the city draw on stylistic precedents from a fairly wide Sicilian context, a number of features are particular to material from Akragas.

229 Examples of diadems include antefix type A and B from Selinus from the first half of the 5th century, an antefix from Megara Hyblaea from the 6th century, and a number of different antefixes from Gela from the 6th century BC, cf. Panvini 1998, pp. 33, 44.

230 Examples of antefixes with snakes include antefixes from the ship sheds at Naxos from the 5th century (Lentini et al. 2008, fig. 41) and some from Himera dated to the end of the 6th or the beginning of the 5th century BC (Epifanio Vanni 1993, p. 40, fig. 5).

231 De Miro 1965, p. 51.

232 Brea 1949, pp. 39-42, 47-56, fig. 28, 36-39; Lang 2010, pp. 94-95, no. Gela 3, fig. 4.5-6, 5.1; Wikander 1986, pp. 33-34, no. 7-8, fig. 8.

233 Conti 2012, pp. 113-127, roof 14, fig. 108; Lang 2010, pp. 131-132, Seli 3, fig. 28.6-8.

234 Ciurcina 1993, pp. 30-31, fig. 4,5.

4.2 FABRIC TYPOLOGY

The overview of the history and current state of research on architectural terracottas emphasizes production techniques as an important new area of investigation (chapter 2). In essence, the production of architectural terracottas is significantly influenced by two factors: the decisions made by the craftsmen and the availability of resources, which includes raw materials and skilled labour. The final appearance of an object is thus determined by the selection and preparation of raw materials, the forming and finishing of objects as well as the firing process, to name but a few.¹ Each of these steps leaves characteristic traces on the finished product which can be recognized and described using standardized methods. For example, the temper that was added to the raw clay can be described using standardized charts to specify its distribution, shape, and size.² A recognized and described characteristic is termed an attribute. As discussed in chapter 3, such attributes need to be mutually exclusive, in other words, one attribute cannot be directly correlated to another.³ These attributes will be labelled independent attributes. The first section of this chapter will thus involve the identification and evaluation of various attributes for the architectural terracottas from Akragas (section 4.2.1). The second section (section 4.2.2) organizes the fragments into groups, or types, according to relevant attributes identified in the first section. The creation of a typology based on independent attributes associated with raw materials and production techniques is common in pottery studies and is frequently referred to as fabric or ware categories.⁴ In this investigation we will use the term 'fabric typology', but it is

important to note that this typology describes not only the materials used but also the production techniques. The fabric group for each individual fragment is provided in appendix A. The attributes data for each individual fragment is provided in appendix B.

While the methods and theories applied to this chapter are detailed in chapter 3, it is important to briefly emphasize two important points at this stage. The first note is in regards to the separation of fabric typology and stylistic categories.⁵ In pottery studies there is the assumption that production techniques are in fact slower to change than style.⁶ In theory it is feasible that a single workshop could create different styles of architectural terracottas over a wide span of time by using the same raw material sources and methods of manufacture. Style and fabric appear to be independent processes and are, therefore, investigated separately in the analytical portion of this thesis, with the discussion of the stylistic aspects in chapter 4.1. The second important note is in regards to the methodological limitations. The established method used for describing the fabric requires a fresh break. Over time the accumulation of dirt and the encrustation of mineral salts obscure the true colour and visual appearance of the clay fabric and its inclusions. In ceramic studies a fresh break is created breaking a small piece from the object.⁷ In most circumstances, it was not possible to utilize a destructive analytical method for objects which form part of museum collections. The exception are the roof tiles from the S. Anna excavations. Observations were thus limited to areas of clean breaks already present due to modern damage. The available data for all 265 fragments studied, as well as the observation limitations, are noted in appendix A and B. The data in appendix B forms the basis for the analysis of aspects relating to materials and methods of

1 Orton & Hughes 2013, p. 151.

2 Orton & Hughes 2013; Rye 1981.

3 Adams & Adams 1991, p. 91; Winther-Jacobsen 2010, p. 59.

4 Adams & Adams 1991, p. 183; Moody et al. 2003, p. 49, tab. 4; Orton & Hughes 2013, p. 71; Shepard 1956, p. 306; Winther-Jacobsen 2010, p. 51.

5 Horejs et al. 2010, p. 10; Jung 2010, p. 148.

6 Rye 1981, p. 5; Shepard 1956, p. 314.

7 Moody et al. 2003, p. 54; Orton & Hughes 2013, pp. 75-76, 155.

production. In essence, within the following sections summaries of specific parameters of the dataset are presented.

4.2.1 DEFINING AND EVALUATING ATTRIBUTES

4.2.1.1 FABRIC COLOUR

Colour is one of the most widely used fabric attributes used in archaeology for categorizing ceramic and terracotta objects.⁸ The colour of the natural clay within the fabric of the object depends on the amount of iron compounds and the carbon substances that come from organic materials.⁹ As the quantity varies between clay sources, colour can therefore be used to distinguish between objects manufactured using different raw sources. Some colour variation is seen in complete objects due to differences in firing, weathering, and depositional conditions. However, it is thought that the fabric colour of wares produced by the same workshop is consistent enough in order to distinguish between wares produced by different workshops.¹⁰ To minimize the impact of such factors as firing and depositional conditions, care was taken to measure colour on clean fractures and careful distinction was made between colour zones created by incomplete oxidation. For further analysis only the colour associated with completely oxidized fabric is used. Therefore, if the correct methods are used, the colour difference between objects of the same fabric group is smaller than the differences in colour between objects from different groups. In conclusion, while there are conditions that can cause variance in the colour, it is an important characteristic of the particular raw source used for production.

For describing colour in pottery studies the Munsell soil colour charts and classification system

are the standardized method.¹¹ Each Munsell code contains key identifiers for the hue, chromaticity, and lightness of a specific colour. In addition, each code has an equivalent textual description. Different codes of a similar colour are frequently described using the same textual description, for example, 5YR 6/6, 5YR 6/8, 7.5YR 7/6, and 7.5YR 7/8 are all described as reddish yellow. It is frequently this textual description that is used when objects are categorized according to colour, which means in essence the analysis is based on groups of verbal Munsell descriptions.¹² Nevertheless, the description and number categories applied are a point of debate with some scholars proposing alternative systems.¹³ The observation conditions in this study are less than ideal due to the restricted use of fresh breaks. A greater variance in the range of colour recorded for objects from the same group is therefore expected. To accommodate such variance, broader categories for colour were used for this analysis. They include a greater number of colour codes and as such reduce the impact of variability to the observation restrictions. Munsell codes from 10R to 2.5YR are described as reddish, from 5YR to 7.5YR as reddish yellowish, and from 10YR to 2.5Y as yellowish. These three categories are further defined according to hue and chromaticity into two groups, one being lighter than the other. For instance, 5YR 6/2 is specified as pale reddish yellowish. The specific recorded data and the colour for each fragment are listed in appendix B. A summary is provided below in table 4.2-1. The fragments appear to fall within four major colour groups: reddish, pale reddish yellowish, reddish yellowish and pale yellowish. For 22 out of 265 objects the colour could not be determined, the individual reasons are provided in appendix A..

8 Ciurcina 1997; Cooper 1990; De Miro 1965; Kenfield 1997; Kjellberg 1940; Lulof 2007; Vanni 1997.

9 Gnesin 2012, p. 497; Malacrino 2010, p. 42.

10 Orton & Hughes 2013; Rye 1981, p. 119.

11 Abramov et al. 2006, p. 261; Ferguson 2014, pp. 329-331; Goodwin 2000, p. 19; Moody et al. 2003, p. 47; Orton & Hughes 2013, pp. 73, 155-156.

12 Orton & Hughes 2013, p. 156.

13 Ferguson 2014; Moody et al. 2003, p. 47, tab. 3; Orton & Hughes 2013, p. 156.

Table 4.2-1: Number of fragments according to each analytical colour group

Colour group	Number of fragments
Greyish	11
Pale reddish	11
Pale reddish yellowish	66
Pale yellowish	37
Reddish	69
Reddish yellowish	43
Yellowish	6
Unknown	22
Total	265

4.2.1.2 TEMPER

Raw clay is likely to crack when drying due to differential shrinkage. Craftsmen add aggregates such as sand, natural rock, grog, and cut straw to it to prevent this from happening. Within pottery studies the use of the term ‘temper’ denotes deliberate additions to the clay. The type of temper is a very distinctive and relevant indicator of different fabric groups. Moody et al. relies on temper as one of the primary indicators of specific fabric groups.¹⁴ While the identification of temper based on a visual inspection alone is rather limited, the following temper types could be distinguished within the material from Akragas:

Volcanic gravel: The rather distinctive temper group consists of dark grey, dark red, and dark brown particles with a rounded form that are likely volcanic or basaltic materials.

Non-volcanic gravel: Compared to volcanic material, the temper group is differentiated by angular shaped grains of a lighter colour likely derived from the local calcarenite or marine sands.

Grog: Grog is ground terracotta fragments left over after firing. It is therefore often similar in colour to the main clay fabric. Due to the

colour and friability of the local stone it can be difficult to distinguish between grog and non-volcanic temper.

Organic material: During the firing process organic material is completely destroyed. Identifying the presence of organic temper is thus limited to a study of the voids left in the clay matrix. While the resultant voids are not always distinguishable from simple air cavities left within poorly processed clay, some types of material, such as cut straw, leave distinctive voids that are easily recognizable.

In table 4.2-2 the temper data as provided in appendix B is summarized. For example, only 29 fragments have volcanic temper, while the majority of the fragments contains a mixture of grog and non-volcanic temper. For 102 fragments it was not possible to determine the type of temper due to the state of preservation and/or absence of fresh breaks. Based on this analysis the following important observations can be made in regards to the material from Akragas. Firstly, volcanic material and non-volcanic material, including grog, are not used in combination. In comparison grog and non-volcanic material are often combined. Secondly, organic temper is never used as the primary temper and is always used in combination with non-volcanic material and grog. Furthermore, it is also apparent that volcanic temper fabrics are not a frequent occurrence for

Table 4.2-2: Temper types and combinations.

Temper type	Number of fragments
Grog	19
Non-volcanic	7
Non-volcanic and grog	100
Non-volcanic, grog and organic	8
Volcanic	29
Unknown	102
Total	265

¹⁴ Moody et al. 2003, p. 49.

Table 4.2-3: Summary of basic temper data for each major type of temper used.

Temper Type	Average minimum grain size	Average maximum grain size	Average percentage	Average sorting
Grog	0.6 mm	4.4 mm	5.8 %	Fair
Non-volcanic	0.6	3.8	3.9	Fair
Non-volcanic and grog	0.4	2.7	3.8	Fair
Volcanic	0.5	2.2	11.5	Good

Table 4.2-4: Types of temper according to types of architectural terracottas.

Type of architectural terracotta	Grog	Non-volcanic	Non-volcanic and grog	Unknown	Volcanic	Grand total
Antefix	1	5	6		2	14
Cover tile	2		4			6
Eaves tile	1					1
Geison revetment	5	6	19	1	3	34
Horizontal geison Revetment			2			2
Horizontal sima			1		2	3
Horse rider acroterion	6	17		1		24
Lateral geison revetment		2			1	3
Lateral sima	1		18	1	7	27
Lion headed waterspout			1			1
Other		5		1	2	8
Pan tile	7	1	7			15
Raking geison revetment			1			1
Raking sima	1	2				3
Ridge palmette	8	22	20	6		56
Ridge tile	6	6	7		3	22
Ridge tile antefix			1		1	2
Sima		3	18		5	26
Sima corner fragment		1				1
Unknown	1		2	1	2	6
Waterspout		2	8			10
Total	39	72	115	11	28	265

the objects from Akragas.

The use of organic temper requires some additional clarifications. It is important to distinguish between temper, which is organic material deliberately added by the workmen, and accessories, which are organic material that is part of the natural raw clay. The absence or presence of accessories is indicative of the specific methods used for refining the raw clay and will be discussed in detail in relation to fabric density (section 4.2.1.3). The only organic temper that can be clearly identified is cut straw, which leaves a distinctive void and imprint in the fired fabric. Of the eight fragments in which organic temper is identified, all were lateral sima fragments in which the organic temper was restricted to the slurry used for connecting the waterspouts, which are formed separately, within the sima (VIN 267, 355). Slurry is a clay mixture with a higher water ratio and is used predominantly for connecting differently formed elements before firing. The presence of organic temper is therefore restricted to only one type of architectural terracottas, namely lateral simas. It would therefore be misleading to use it as a general attribute to define objects of the same fabric type, since it will exclude all other types of architectural terracottas.

Additional characteristics of the temper groups are recorded based on systems devised for the Department of Urban Archaeology of the Museum of London as published by Orton and Hughes.¹⁵ The type of data collected is restricted to what is observable to the naked eye on existing fractures only and the following criteria were therefore selected. The size of the temper is recorded as a range in mm using the chart published by Mathew, Wood, and Oliver as reference, the same chart is also used as a standard for identifying the percentage of temper or voids in relation to the overall fabric.¹⁶ A chart by Barraclough is assigned as reference to describe the level of sorting of

temper grains on one hand on a scale from 1 to 5, with 5 indicating an even distribution of uniformly sized temper grains. On the other hand, the sorting scale includes also descriptions as 'very good', 'good', 'fair', 'poor', and 'very poor'.¹⁷ The summary in table 4.2-3 is derived from the data in appendix B. There is a concern regarding the independence of some attributes related to temper. As seen in table 4.2-3, objects with volcanic temper have a smaller average grain size and a higher density in comparison to fragments with grog or non-volcanic temper. At least some of the attributes related to temper appears to be influenced by the type of temper, and are thus not independent variables.

As seen with the use of organic temper, it is possible that the type of architectural terracottas might influence the choice of the temper used. For this reason, table 4.2-4 compares the number of fragments in each temper type according to the type of architectural terracottas. In general, most architectural terracottas including antefix, sima and geison revetment pieces are produced using all the temper types. The exceptions are the undecorated roof tiles (pan and cover tiles) as well as the ridge tile palmettes, acroteria, and waterspouts which use only non-volcanic temper and grog. The factors at play here might be rather complex, involving changes in production techniques over time; the pan tiles, for example, are all dated to the 5th century and later (section 4.1). This matter will be explored in detail in chapter 7 as it depends on the results of more than just the fabric analysis. At this point is enough to note that while there are some exceptions, the majority of architectural terracotta types are produced using all the major temper groups and as such the type of temper is not restricted to specific roof elements.

4.2.1.3 DENSITY

Raw clay contains numerous undesired material including pebble and organic matter. Such

¹⁵ Orton & Hughes 2013, pp. 275-284.

¹⁶ Orton & Hughes 2013, p. 282, fig. A.4.

¹⁷ Orton & Hughes 2013, p. 284, fig. A.6.

Table 4.2-5: Number of fragments per temper type according to the percentage of air cavities.

Temper type	2 %	5 %	10 %	20 %	Unknown	Total
Grog	6	15	6		12	39
Non-volcanic	6	6	4		56	72
Non-volcanic and grog	30	65	10	1	9	115
Volcanic	24	2	1		1	28
Unknown					11	11
Total	66	88	21	1	89	265

accessories should not be confused with temper, which is added deliberately.¹⁸ In general, clay is first refined at the start of the production process in order to remove unwanted material. This can be as simple as removing large accessories by hand after breaking open all the clumps. Other methods include sieving dry clay or levigation, which involves dissolving the clay in a bath of water and allowing heavier particles to settle at the bottom. Based on evidence observed within the archaeological record, through experimental archaeology, and ethnographic studies, it has been determined that all three refining methods are associated with terracotta production during the Archaic and Classical period.¹⁹ After the initial refinement, the clay is wetted, temper is added and then blended.²⁰ The blending process is especially important since an even distribution of temper and moisture is desirable to prevent cracking while firing objects. During the experimental making of Corinthian roof tiles, workmen accomplished this by mixing the clay with a shovel and by physically stomping on the clay.²¹ An additional advantage of blending and compressing the clay is the removal of air bubbles. Trapped air can cause cracking and warping during the firing process as gasses expand with heat.

The extent to which raw materials were refined varies within the objects from Akragas. There is

evidence that the clay used for some objects went through an abbreviated refining process. This is seen in an uneven distribution of temper grain sizes and a higher percentage of small air cavities. These voids are indicative of both the number of organic accessories within the clay as well as incomplete blending. The amount of voids, or air cavities, is thus a sign of the degree to which the raw clay was refined and blended. The amount of visible air cavities that are not associated with organic temper is measured as a percentage of the overall fabric by using the same standardized charts to measure the average percentage of temper. The data is provided in appendix B. A summary of the percentage of voids recorded for each fragment, according to temper type, is provided in table 4.2-5. Of the 28 fragments with volcanic temper, 24 have a void density of 2 percent or less. This indicates that the workmen who used volcanic temper also used a more refined clay. While it appears that the percentage of voids varies according to the type of temper used, this is due to the production processes used and not directly related to the type of temper. For this reason, the density of the fabric is considered an independent attribute.

4.2.1.4 OXIDATION

The difference in colour between the raw clay and fired fabric is the result of the oxidation of iron particles in the natural clay. This occurs when the object is fired at a temperature of around 700° C or higher for longer than eight minutes.²² It should be noted that this figure is based on pottery and the specific time required for thicker terracotta objects

18 Rye 1981, p. 16.

19 Malacrino 2010, p. 44; Rostoker & Gebhard 1981, p. 213; Rye 1981, pp. 17-18; Winter 1993, p. 305.

20 Henrickson & Blackman 1999, pp. 313-314.

21 Rostoker & Gebhard 1981, p. 215.

22 Orton & Hughes 2013, p. 73; Rye 1981, p. 25.

Table 4.2-6: Number of fragments per temper type according to the level of oxidation.

Temper type	Completely oxidized	Fairly complete	Incomplete oxidation	Misfired	Unknown	Total
Grog	12	18	1		8	39
Non-volcanic	10	9	3		50	72
Non-volcanic and grog	41	46	13	1	14	115
Volcanic	23	2	3			28
Unknown	1				10	11
Total	87	75	20	1	82	265

Table 4.2-7: Number of fragments per type of architectural terracotta according to the level of oxidation and temper.

Type of architectural terracotta	Complete oxidation	Fairly complete	Incomplete oxidation	Misfired	Unknown	Total
Antefix	5	4	2		3	14
Cover tile	3	3				6
Eaves tile		1				1
Geison revetment	7	17	3		7	34
Horizontal geison revetment		1			1	2
Horizontal sima	2		1			3
Horse rider acroterion		6			18	24
Lateral geison revetment	1				2	3
Lateral sima	14	8	1		4	27
Lion headed waterspout		1				1
Pan tile	9	4		1	1	15
Raking geison revetment		1				1
Raking sima		1	2			3
Ridge palmette	24	6	3		23	56
Ridge tile	2	10	4		6	22
Ridge tile antefix	2					2
Sima	7	11	1		7	26
Sima corner fragment					1	1
Waterspout	8				2	10
Other	1		2		5	8
Unknown	2	1	1		2	6
Total	87	75	20	1	82	265

is likely to be more. In an oxygen rich environment this process starts from the outside of the object to the inner core. A colour difference between the margin and the core of an object is therefore evidence of incomplete oxidation, which is normally the result of lower or not sustained firing temperatures.²³ The level of oxidation for each fragment is recorded in appendix B. If the fragment has a uniform colour throughout the visible fracture then the oxidation is considered complete. A slight colour difference between the margin and core indicates that the oxidation process is close to completion. A greyish core colour is then the evidence of incomplete oxidation. A summary of the oxidation levels according to each temper type is provided in table 4.2-6.

While it is not certain if the type of temper used has an impact on the level of oxidation, there does appear to be some correlation. As can be seen in table 4.2-6 none of the fragments with volcanic temper showed evidence of incomplete oxidation; in fact, 23 out of the 28 fragments with volcanic temper were completely oxidized. The fragments with grog and non-volcanic temper have a roughly equal distribution of completely oxidized and fairly complete oxidized fragments.

The thickness of an object can also influence the oxidation process since thicker objects require a longer firing time than thinner ones. In addition, some types of architectural terracottas, such as ridge tiles, are composed of elements of varying thickness. In order to gain an impression of the relationship between the type of architectural terracotta and the level of oxidation a summary of the data of appendix B is provided in table 4.2-7. As can be seen, of the 22 ridge tile fragments, only two are completely oxidized. However, of the 15 pan tile fragments, nine are completely oxidized. This might be because the thickest portion of the pan tile is smaller than the thickest portion of the ridge

tile (sizes and profiles are provided in section 4.1.3). While the level of oxidization is thus an important indicator of firing conditions, it is not a very reliable independent aspect for identifying fabric groups, as the type of architectural terracotta object itself appears to influence the level of oxidation.

4.2.1.5 FORMING TECHNIQUES

The architectural terracottas from Akragas vary in terms of the complexity of the profile and decoration. While a cover tile consists of a fairly simple profile, an anthemion sima with perforations and decoration in relief is much more complex. The techniques for forming the different types of architectural terracottas is thus varied. Based on relevant studies as well as visual observation of fragments (appendix B) the following methods have been identified for the objects from Akragas.

MOULDS

Moulds are made of wood or terracotta and are used for forming complex shapes. As seen on the gorgoneion mould in terracotta from the urban sanctuary at Akragas (figure 4.2-1), elements in relief are in the negative. The clay is layered into the mould, compressed, and allowed to dry until firm, or leather-hard, before being removed.²⁴ The objects from Akragas were formed upside down, with the back exposed. In general, the back of objects is rougher and shows evidence of being scraped flat with a straight edged tool such as a wooden plank (e.g. VIN 145, 166, 184). When an object requires moulded relief on both the front and back, the two halves are formed separately and then joined before firing (e.g. VIN 364, 370, 619). The gorgoneion mould VIN 243 is of a size similar to the antefixes documented in section 4.1. The closest comparison in terms of decoration is antefix I (section 4.1.30) since it also has a single row of spiral curls consisting of two turns each. However, not enough of the antefix is preserved to determine if this object comes from exactly this

23 Abramov, et al. 2006, pp. 261-263; Rye 1981, p. 119.

24 Rostoker & Gebhard 1981, pp. 220-221; Winter 1993, p. 304.

mould. The gorgoneion plaque (section 4.1.34) is also very similar, but there are variations in the curls as well as the shape and position of the brow.

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Figure 4.2-1: Mould for gorgoneion plaque (VIN 243. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

SLABS

Easier forms were created using clay slabs that had been roughly fashioned on the ground or a table by using a rectangular form and/or a roller. The slabs are then shaped over simple forms while the clay is still moist. This method appears to be in widespread use from early simas in Delphi²⁵ to Hellenistic cover tiles at Gordion.²⁶ According to Le Roy early simas from Delphi were too large to form in a mould. He suggests that the clay was first formed into a slab, and then shaped on a simple form with the front surface exposed. The front surface was finished by using a template to scrape along the surface.

²⁵ Le Roy 1967, pp. 202-203.

²⁶ Henrickson & Blackman 1999, p. 311.

POTTER'S WHEEL

A small number of rounded objects, primarily the waterspouts, were formed using a potter's wheel in a similar method as that used for pottery.²⁷

HAND SCULPTING

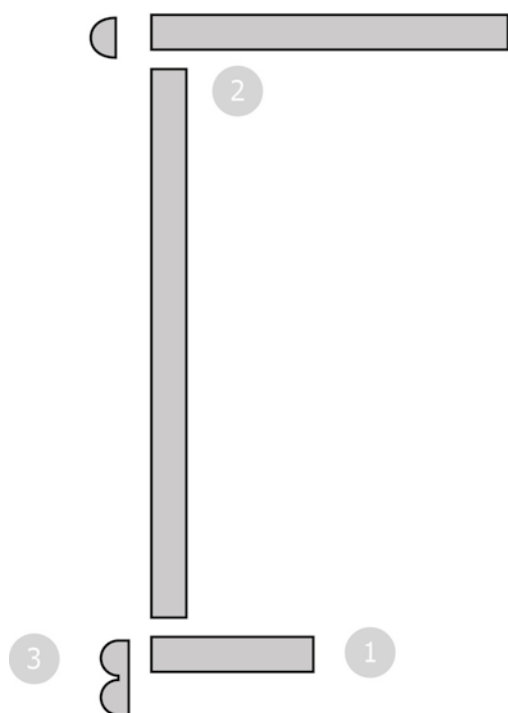
While moulds are useful for the production of smaller scale objects, it was not appropriate for all types of architectural terracotta. Larger and complex shapes, such as fully rounded forms, could not be made in a mould if the moulded form would pinch the shape and prevent removal. For this reason, more intricate objects, such as acroteria sculptures, were sculpted by hand.

COMBINED TECHNIQUES: SLAB AND MOULD FORMING

Several objects were formed as separate pieces in separate moulds or forms and then connected while the clay was leather-hard. For example, moulded antefixes were made using a mould for the plaque while the cover tile was formed separately by shaping a slab of clay over a rounded form. On some antefixes it is quite apparent that the plaque and cover tile were formed separately. On VIN 332 the plaque has a very low percentage of inclusions, compared to the connected cover tile, which indicates that the two objects were formed separately using different fabric groups.

While Le Roy suggests that early simas from Delphi were constructed using slabs, as described above, it appears that this method was used for some of the geison revetments and not the simas at Akragas. Evidence for this forming method can be seen in visible marks left in the surface of objects and in the fractures of the connections. A reconstruction of this process of combined techniques is shown by the example of a geison revetment (section 4.1.1, 4.1.2, 4.1.19) which various elements and production marks are presented in three steps as illustrated in figure 4.2-2.

²⁷ Winter 1993, p. 306.



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Figure 4.2-2: Reconstruction of the manufacturing process for geison revetment A with its five elements, which are separately formed and the joined. Visible marks on different fragments (VIN 263, 295, 351. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

1. On the back of the soffit flange, a number of fragments contain a vertical groove. The striations in this groove indicate the object was formed while the clay was still wet. Reproduction experiments performed on early Greek roof tiles have found that removing objects from the mould can be extremely challenging and that additional steps are required to achieve successfully this task.²⁸ The marks left in the clay appear to be from a flat tool which was inserted at the side of the object and then tilted slightly in order to lift the bottom of the object from the mould. This action would also account for the slightly curved profile of the bottom flange as seen in figure 4.2-2.1. The position of the mark on the back edge of the bottom flange is quite significant. It indicates that the mould or

form for this element included an unmovable vertical panel for the back edge. The important thing to note here is that this vertical panel would prevent removing the geison revetment if it was formed as a whole. The vertical panels at the top and bottom would pinch in the clay object. Therefore, it is evident that a single mould or form for the entire revetment was not used. Rather it suggests that the main elements were made separately in simple forms and then pressed together while the body have not yet completely dried.

2. The fracture seen in figure 4.2-2.2 would support this theory. The slight vertical and horizontal marks in the fractured edge of a geison revetment fragment indicate that the top flange, vertical geison revetment fascia and top roll were all formed separately and then joined while the clay was still leather-

²⁸ Rostoker & Gebhard 1981, p. 222.

hard. This join can be seen between the front edge of the top flange and roll as well as the top flange and the main vertical face of the geison revetment. It is not very pronounced though, there are no air cavities caught between two elements and rarely do breaks occur here. On the back, the corner join shows very little indication of extra clay or slurry. All this indicates that the separate pieces were joined using pressure and little or no slurry.

3. The regularity and dimensions of the top and bottom rolls would suggest the use of a form as opposed to rolling the elements by hand. The shape and position indicate that they were likely formed in separate forms, one for the top, one combined form for the two bottom rolls together. The use of a mould for the bottom rolls would create a sharp, almost 90-degree edge for the back of the hanging roll. It appears that this edge was smoothed and rounded by hand which accounts for the irregularity seen on the back of the hanging roll (figure 4.2-2.3).

After the various individual elements had been joined and before the fabric became bone-dry, a wooden or metal template was used to scrape along the outer surface to provide for a neater and more uniform shape. Slight vertical grooves formed in the soft clay of the surface of the vertical face as well as the rolls support this theory (VIN 281, 285, 294).

COMBINING OBJECTS

As described in the above section regarding the various methods of forming roof terracotta, some methods involve combining separately formed objects. Before firing they are connected before the clay becomes bone-dry. To accomplish this joining it is common to use a slurry.²⁹ The antefixes from Akragas all show a thickening of the cover tile where it meets the plaque which indicates the use of wet clay to facilitate the join. In the case of antefix

B (VIN 384, 385) the thickening is on the outside edge while the rest of the objects show fortification on the inside join. Slurry or wet clay was also used with the canonical Sicilian sima. The waterspouts (VIN 293, 294) were formed on a potter's wheel and fixed in using a soft clay or slurry. The soft clay was shaped like a ring around the base of the spout against the main fascia. This served the dual purpose of concealing the join as well as providing additional stability to the waterspout, as can be seen on VIN 267 and 355 (figure 4.2-3) The gap between the waterspout and the hole in the sima is visible in the area where part of the ring is now missing. Since this ring is formed by hand its shape is less consistent. It often slightly overrun onto the top and bottom rolls of the fascia strip where the ring is located (figure 4.2-3).

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Figure 4.2-3: Evidence of wheel made waterspout fixed in with soft clay which is shaped into a ring around the base of the spout to cover and reinforce the join (VIN 267 and 355. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

Objects can also be combined by using pressure instead of slurry or soft clay. If enough pressure is

²⁹ Winter 1993, p. 306.

applied to the join while the clay is not yet leather-hard, then the two objects will seal together. Thus, there will be no air gap between the previously separate pieces and, if the surface is smoothed over, the join becomes invisible.³⁰ The separately formed geison revetment fragments described above (figure 4.2-2) are an example of this.

When both sides of an object are decorated in relief the two sides are formed separately in moulds and then joined together while the clay is hard but still slightly moist. The ridge palmettes are good examples for this production method. Because the two separate halves are connected, while the clay is still slightly wet, it is not possible to exert a lot of pressure when joining the objects otherwise the relief pattern will be distorted. Therefore, large air gaps are visible within the join on some of the fragments (figure 4.2-4) and a number of objects broke later on along this join (VIN 588, 589, 592, 598, 600).

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Figure 4.2-4: The join between two sides of a ridge palmette formed in separate moulds. The epidermis layer is clearly visible (VIN 365. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo)

SECONDARY FORMING

The majority of fragments in the dataset shows traces of secondary forming (appendix B). This occurs after the objects had been removed from the mould or form, but before the fabric had dried out completely and is therefore still soft enough to cut with a knife. The stepped join on sima fragments (VIN 257, 260, 265, 355) was formed by hand while the clay was still pliable. The perforations on perforated sima fragments (VIN 138, 146, 177) show also the marks left by a knife in wet clay. On the geison revetment plaques, holes were made for the nails which were needed to fix the objects later to the building. Decorations in relief such as hawksbeak, Doric leaves, or figurative motifs on antefixes were retouched or sharpened with a pointed implement. The curvature of the clay around the retouching indicates that the clay was still relatively malleable, even after the primary forming process. The level of malleability raises a concern over unwanted deformation, because even slightly deformed objects have an impact on how well they fit together as a roof. The methods used for addressing this situation will be described in detail in section 4.4.

FORMING TECHNIQUES USED IN AKRAGAS

The forming techniques used for each fragment can be identified by the characteristic traces left on the objects themselves and according to the production principles described above. The multiple evidence for forming techniques for each individual fragment is provided in appendix B. A summary of the number of fragments of each architectural terracotta type according to the forming technique used can be found in table 4.2-8.

The type of architectural object determines the method of forming. Of the 34 geison revetment fragments identified the majority was formed using a combination of moulds and slabs. Antefixes with decoration in relief are formed by using moulds

³⁰ Lulof 1991, p. 119; Rye 1981, p. 72.

Table 4.2-8: Number of fragments according to architectural type and method of manufacture.

Type of architectural terracotta	Slab and hand formed	Mould	Mould and slab	Slab	Unknown	Wheel made	Total
Antefix			10	3	1		14
Cover tile			3	3			6
Eaves tile				1			1
Geison revetment		6	21		7		34
Horizontal geison revetment			2				2
Horizontal sima		3					3
Horse rider acroterion	19				5		24
Lateral geison revetment		1			2		3
Lateral sima		25			2		27
Lion headed waterspout	1						1
Pan tile			13	1	1		15
Raking geison revetment			1				1
Raking sima		3					3
Ridge palmette		44			12		56
Ridge tile		3	12	2	5		22
Ridge tile antefix			2				2
Sima		24			2		26
Sima corner fragment					1		1
Waterspout						10	10
Other	1	1	2		4		8
Unknown		5			1		6
Total	21	115	66	10	43	10	265

and slabs as well, ridge palmettes are all formed using only moulds. The method of manufacture is thus determined by the type of architectural terracotta and can therefore not be considered as an independent attribute.

4.2.1.6 SURFACE FINISH

The architectural terracottas of Akragas demonstrate a number of different finishing methods which were formed or applied to the surface of the main fabric body of an object before firing. The described methods of forming as well the specific temper produced finished surfaces of varying quality whereas the smoothness has an impact on the visual appearance of the object itself. Sicilian workshops employed various techniques

in order to improve the final surface which are described in the following.

EPIDERMIS

This method of manufacture seen in Greek architectural terracottas makes use of two separate layers of fabric placed in a mould. The first layer, called the epidermis, can vary between a couple of millimetres up to a centimetre in thickness. It consists of very fine, highly levigated clay that is placed in the mould first. After this layer a heavier, tempered clay is added (figure 4.2-5). The fine clay of the epidermis layer thus forms an outside surface that is very smooth and with sharper definition

in the moulded decoration.³¹ According to Lulof this technique is very difficult to fire without cracking the thinner, less tempered epidermis and is, therefore, considered a technique that requires considerable skill and knowledge.³² It appears on all types of architectural terracottas including geison revetment, sima, ridge tile, and antefix fragments from Akragas (table 4.2-9).

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Figure 4.2-5: Epidermis layer on top of tempered clay (VIN 181. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

SLIP

Within Greek and Italian architectural terracottas the use of a slip is well documented. It involves the application of a thin layer of fine clay to an object after it is removed from the mould.³³ The slip layer can be distinguished from the epidermis technique because the latter is added during the moulding process and is only applied to the front surface. In contrast, the slip is added after the object has already been moulded and can cover the entire surface. The slip layer is generally thinner than the epidermis layer and of a relatively uniform thickness. Distinguishing between a slip layer and the paint layer is more complicated by the fact that the white paint used for decoration is most

often finely levigated white clay which is similar in appearance to the slip layer. For the purpose of this study only a layer that clearly covers the entire original surface is categorized as slip. The slip layer is slightly thicker than painted layers and can still be seen in areas where the paint has flaked off. A number of examples exist of where the both an epidermis and a slip layer are applied to an object, including VIN 365 (figure 4.2-6). Here, the epidermis consists of fine red clay that is applied while forming the object with a mould. Slight air gaps are still visible between the epidermis layer and the main fabric body. After removing the object from the mould, a pale yellow slip is applied either by brush or by dipping the object. Traces of red paint are still visible on top of the bright slip layer.

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Figure 4.2-6: Fragment of ridge tile palmette showing grog laded fabric core, a fine red epidermis layer and a light coloured slip layer with traces of red paint on top (VIN 365. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

PAINT ONLY

A number of fragments from Akragas have the painted decoration applied directly on the main

31 Kenfield 1997, p. 107.

32 Lulof 1991, p. 132.

33 Conti 2012, pp. 36, 60, 89; Kenfield 1997, p. 107; Lulof 1991, p. 132.

fabric body before firing. It appears that when the clay matrix is pounded into the mould or form the pressure and vibration forces moisture and finer particles to the outsides, creating a smoother surface layer. The effect is more successful for the grog laded fabrics. The ones containing volcanic material as temper have a more uneven surface finish with the temper particles visible even through the painted decoration (figure 4.2-7). In general, an uniform paint layer covering all the surfaces was added.

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Figure 4.2-7: Dark grain temper visible through painted finish (VIN 137. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

FINISHING TECHNIQUES USED IN AKRAGAS

As discussed in the preceding sections, in essence, it is possible to distinguish between four different techniques used for finishing the surfaces of the architectural terracottas from Akragas: an

epidermis layer, a slip layer, a slip and epidermis layer, and lastly a paint layer applied directly to the main fabric. These methods are recorded for each fragment in appendix B when a clean fracture and the level of preservation allow for visual identification of the finishing technique. A summary is provided in table 4.2-9. The fragments are again divided according to architectural type and then the number of fragments exhibiting each finishing technique is indicated. As can be seen, the most commonly used finish is the slip layer, with 82 fragments in total. 65 fragments are finished with the paint-only technique. The use of a slip and epidermis layer is not very widespread and is restricted to ridge tile palmettes except for a single ridge tile.

4.2.1.7 PAINTED DECORATION

Paint is usually applied after the object had been formed and allowed to dry, but before firing.³⁴ The majority of the painted decoration is added by hand except for the guilloche pattern on the geison revetments, which was drawn using a compass.³⁵ On a number of geison revetment fragments there are small circular depressions in the centre of each circular band that was left in the wet clay by the needle of the compass (figure 4.2-8.a) (VIN 276, 354).³⁶

The level of execution of the painted decoration varies but there are major tendencies traceable. On some geison revetment fragments an abundance of mistakes and corrections is visible; outlines do not connect or overlap, lines and bands differ in width, and some bands veer away from the painted outline (figure 4.2-8.a). On the other end of the spectrum there are examples (figure 4.2-8.b), in which the painted lines are consistent in width with sharp edges and a uniformly applied thickness. The level of execution for each fragment is rated from

³⁴ Kenfield 1997, p. 107; detailed Winter 1993, p. 306 for Greek architectural terracottas and Lulof 1991, p. 120 for Etruscan architectural terracottas.

³⁵ Winter 1993, p. 306.

³⁶ De Miro 1965, p. 42.

Table 4.2-9: Number of fragments per type of architectural terracotta according to the finishing technique used.

Type of architectural terracotta	Epidermis	None	Paint only	Slip	Slip and epidermis	Unknown	Total
Antefix	3			8		3	14
Cover tile		3		2		1	6
Eaves tile				1			1
Geison revetment	3		10	19		2	34
Horizontal geison revetment			1			1	2
Horizontal sima	1		1	1			3
Horse rider acroterion	1			18		5	24
Lateral geison revetment	1			2			3
Lateral sima	1		20	1		5	27
Lion headed waterspout				1			1
Pan tile		11		1		3	15
Raking geison revetment			1				1
Raking sima			1	1		1	3
Ridge palmette	2		1		34	19	56
Ridge tile		1	5	14	1	1	22
Ridge tile antefix				1		1	2
Sima	2		15	4		5	26
Sima corner fragment						1	1
Waterspout		1	9				10
Other			1	4		3	8
Unknown	1			4		1	6
Total	15	16	65	82	35	52	265

poor to excellent based on these considerations. A summary of the ratings is provided in table 4.2-10, according to each type of architectural terracotta. Most of the fragments do not preserve enough painted decoration and are, therefore, labelled as unknown. From the findings it appears that the level of execution on both sima and geison revetment fragments range from excellent to poor with the majority of fragments falling in the middle.

Guidelines for the painted decoration were incised on objects before the clay became bone-dry. Examples include centrelines for the guilloche pattern (figure 4.2-8), and outlines for hand painted patterns including the meander pattern

(figure 4.2-9). The presence of guidelines is noted for each fragment in appendix B. In general, they appear to be limited to particular patterns such as the guilloche pattern or meander. On objects with moulded decoration, such as gorgoneion antefixes or anthemion simas, there are no incised guidelines for the painted decoration. The presence of such incisions is therefore not an independent attribute as it is linked to the type of object and the forming method.

In essence, the painted decoration comes in a combination of only three colours: red, black, and white. In addition, there is some variation in the specific colour, for example the red can be a purplish red, brick red or reddish orange. The

Table 4.2-10: Number of fragments according to architectural type and level of execution of painted decoration.

Type of architectural terracotta	Excellent	Fair	Poor	Unknown	Total
Antefix		2		12	14
Cover tile				6	6
Eaves tile		1			1
Geison revetment	3	13	2	16	34
Horizontal geison revetment			2		2
Horizontal sima	2	1			3
Horse rider acroterion				24	24
Lateral geison revetment	1			2	3
Lateral sima	4	9	1	13	27
Lion headed water-spout				1	1
Pan tile				15	15
Raking geison revetment			1		1
Raking sima		1		2	3
Ridge palmette				56	56
Ridge tile		9		13	22
Ridge tile antefix				2	2
Sima	2	11	1	12	26
Sima corner fragment				1	1
Waterspout		7		3	10
Other				8	8
Unknown		1		5	6
Total	12	55	7	191	265

white paint consists of light coloured levigated clay. It appears that on objects with a slip or epidermis layer the parts of the design which required a light colour were thus achieved by just leaving the slip or epidermis layer unpainted. For this reason, while recording the colour no further distinction is made between painted decoration with or without a finishing layer. In this analysis, the focus is on the applied colour and a summary of number of fragments in each painted category is provided in table 4.2-11. The painted decoration on a large number of fragments (106 out of 265) could not be determined, because the fragment is either too small or too damaged. White colour alone is not present, but only in combination. 28 fragments show no painted decoration at all, on closer inspection these are pan or cover tiles or palmettes (see appendix A and B). In the case of the palmettes

it seems that the paint colours differentiate between two groups, those with no paint and those with red paint whereas this architectural type represents the majority within the group of fragments with only red paint. Most objects with traces of the painted decoration preserved make use of a decorative scheme in red, black, and white.

Table 4.2-11: Number of fragments according to paint colours used.

Painted colours	Number of fragments
Black only	2
Black and white	8
Red, black, and white	101
Red only	20
None	28
Unknown	106
Total	265

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Figure 4.2-8: Painted decoration, *a*: irregularly applied (VIN 354), *b*: regularly applied (VIN 184. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

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Figure 4.2-9: Incised guidelines for the hand painted meander pattern (VIN 262. Copyright Regione Siciliana - Assessorato Reg.le dei BB. CC. e I. S. - Su concessione del Polo Regionnale di Agrigento - Museo Archeologico "Pietro Griffo" - divieto di duplicazione con qualsiasi mezzo).

4.2.2 A FABRIC TYPOLOGY

In the preceding sections the various attributes related to raw material and production techniques were described and evaluated. This constitutes the first step in the creation of a fabric typology for the present study. The second step involves the selection of appropriate attributes which can be used for identifying a fabric type. An appropriate attribute meets the following criteria: it is responsible for variation in the dataset and it is independent from other variables. Based on this framework the various attributes are subsequently evaluated.

With regard to the first requirement the colour of the painted decoration, as shown in table 4.2-11, is not a suitable attribute as the majority of objects are painted with red, black, and white paint. If the colour of painted decoration was to be used to organize the fragments into different groups then almost all the decorated objects would fall within one group. The painted decoration is therefore not responsible for variation in the dataset and cannot be used in the identification of fabric groups.

The second requirement for an appropriate attribute is independence. The size of temper grains, for example, was shown to be related to the type of temper used and is therefore considered to be a dependent variable. Another example are the forming techniques. Antefixes with moulded relief, for instance, are formed with the use of a

mould while the cover tile is formed by shaping a slab of clay over a simple form before the two objects are joined and then fired. The forming technique is, therefore, determined by the type of object, irrespective of fabric groups. For this reason, forming technique is not an appropriate attribute to use in the creation of a fabric typology.

Based on the above mentioned selection criteria of variation and independence the following attributes were chosen for the identification of specific fabric groups in this study: fabric colour, temper type, fabric density, and surface finish. By using these attributes as variables it is possible to create a large number of groups statistically. However, the fact is that the majority of these groups might not be applicable to the architectural terracottas of Akragas. For example, in table 4.2-5 it is apparent that none of the fragments with grog temper has a void density higher than 10 %. Defining a fabric group with grog temper and void density of 20 % would thus be redundant. The specific characteristics used for defining the fabric types are therefore selected in order to describe the major groupings in the dataset, guided by established groups of objects already identified in section 4.1-4.2. Since the typological categories are created in order to fit a specific dataset, such types are inherently subjective. According to influential scholars in the field of ceramic typology, the purpose of a typology is to distinguish between different groups of objects in a manner that is meaningful to the researcher and the research question. A certain level of subjectivity is therefore unavoidable.³⁷ Eight fabric groups have thus been identified by running queries on the dataset provided in appendix B and taking the criteria identified in this chapter as basis. These groups are:

Fabric A: The group is characterized by a reddish clay (10R 6/6-5YR 6/8) with light coloured inclusions, some of which have a crystalline

structure. A large percentage of the inclusions is identifiable as grog. The percentage of inclusions ranges from 3-5 %. The fabric is fairly dense, with small air cavities at around 5 %. The paint is applied directly on the surface.

Fabric B: The clay colour is reddish yellow (5YR 6/6-7.5YR 7/4). The inclusions are of a similar colour as the clay matrix, some of which can be identified as grog. The fabric has a rather porous appearance, with air cavities at a density of around 10 % and more. The surface finish is a slip layer of clay similar in colour to the main fabric (10YR 7/4).

Fabric C: The fabric matrix has a reddish colour (2.5YR 6/4-10R 6/8) and is rather dense with small air cavities at less than 2 %. The inclusions are of a similar colour as the clay matrix, some of which can be identified as grog, and are at a density of around 2 %. The surface finish is an epidermis of highly levigated clay with few visible inclusions and a similar colour as the main fabric. The epidermis varies in thickness according to the relief of the object. On top of the epidermis there is a 2-4 mm thick slip layer of fine pale yellow clay (10YR 8/2).

Fabric D: The fabric matrix has a pale reddish yellowish colour (5YR 7/3-2.5Y 7/3) and is not as dense as fabric C, with small air cavities at less than 5 %. The inclusions are of a similar colour as the clay matrix, some of which can be identified as grog, and are at a density of around 5 %. The surface finish is an epidermis of highly levigated reddish clay with few visible voids. The epidermis varies in thickness according to the relief of the object. On top of the epidermis there is a 2-4 mm thick slip layer of fine pale yellow clay (10YR 8/2).

Fabric E: The fabric is similar to fabric A except for smaller differences. The clay is a pale yellowish reddish (5YR 7/4-7.5YR 7/3) with a higher density as the small air cavities are at less than 2 %.

Fabric F: The fabric matrix has a reddish yellowish colour (5YR 6/6-7.5YR 6/3) with a high density

³⁷ Adams & Adams 1991, p. 91; Shepard 1956, p. 308; Winther-Jacobsen 2010, p. 49.

and air cavities at less than 2 %. The inclusions are dark reddish, grey or brown grains with a rounded shape, most likely volcanic gravel. The percentage of inclusions range from 7-15 %. The paint is applied directly on the surface.

Fabric G: The fabric is similar to fabric F, except for the presence of a surface finish. The epidermis layer has the same colour as the main fabric.

Fabric H: The fabric matrix has a pale yellowish to yellowish colour and uses grog and non-volcanic temper. The fabric is not very dense, with air cavities of up to 10 %. No surface finish or painted decoration.

33 fragments therefore constitute outliers, isolated examples which do not fall within the major fabric groups and, furthermore, not in the stylistic groups (section 4.1). The fabric group for each fragment as well as reasons why it cannot be assigned to one fabric type is detailed in appendix A.

Table 4.2-12: Number of fragments according to fabric type.

Fabric groups	Number of fragments
Fabric A	39
Fabric B	33
Fabric C	10
Fabric D	8
Fabric E	6
Fabric F	8
Fabric G	9
Fabric H	6
Outliers	33
Unknown	113
Total	265

A brief summary of the total number of fragments within each fabric group is provided below in table 4.2-12. For 113 fragments out of 265 there is not enough information available on the fabric and surface finish. Of the remaining fragments, 119 could be assigned to the eight fabric groups, with the most fragments falling with fabric groups A and B. The attributes for 33 fragments fall outside the main fabric groups. This group contains fragments including VIN 182 and 616, which are part of frieze I and are suspected of being part of a sarcophagus (section 4.1.15), as well as VIN 197, which is the single fragment identified as eaves tile B (section 4.1.36). The majority of the

CONCLUSIONS

While the main aims of this chapter are interconnected, the final products are quite distinct. The achievement of the research aims relies on a systematic investigation of the production process based on the traces left within the finished product. Based on this information it was thus possible to define characteristics, or independent attributes, which define major groups of objects within the 265 fragments from Akragas. The fabric typology is especially important for the identification of objects which belong to the same roof (chapter 5). But this chapter also lays the groundwork for the detailed investigation of the actual manufacture and workshops by identifying preferred raw materials and production techniques. From the choice of raw materials, especially temper, as well as the preparation of such materials to the methods used for forming objects as well as the various techniques for finishing decorated surfaces, all provide important insights into the production of architectural terracottas at Akragas.

The methodological and theoretical framework applied to the creation of the fabric typology is described above in chapter 3. One of the main components centres on the evaluation of each attribute in terms of the impact it has on the dataset as well as the factors that influences it in turn. The importance of using independent variables from a statistical point of view is emphasized by scholars focussing on typologies and is demonstrated in this chapter. For example, the forming techniques used are strongly related to the type of objects being produced. Therefore, a specific forming technique cannot be applied to identify objects from the same roof, as it would exclude objects from the same roof which are made by a different forming technique only because they are of a different architectural type. Through this process the attributes with the most significant impact on the fabric typology have been identified as fabric colour, temper, fabric density, and surface finish.

Furthermore, it has become apparent that, in

essence, there are two types of appropriate attributes for creating a fabric typology of the architectural terracottas from Akragas. One is the independent attribute, such as temper type, which is useful for identifying different fabric groups. The second group of attributes, such as oxidation, forming techniques, and the painting methods cannot be used for the same task as they are all influenced by other factors, including the architectural type of an object. That does not mean that these attributes are not also important to the discussion of production techniques and workshops. Nevertheless, they can only taking into account and discussed once the objects have already been grouped into roofs or types. In essence, they should not be used for identifying or establishing types, but rather for describing existing types. This part of the discussion is therefore located below, once the new roof typology has been defined in chapter 5.

4.3 COMPOSITIONAL ANALYSIS

The most widely used archeometric methods employed in the study of ceramic and terracotta objects from Sicily in the past and present includes thin section petrography and wavelength dispersive x-ray fluorescence (WD-XRF). As discussed in chapter 3, each particular method provides information on a specific aspect of the material under investigation, and it is therefore necessary to use a combination of methods in order to obtain the most comprehensive results.¹ These methods have a well-established methodology regarding the preparation of samples, measuring and analysing results, which will also be used for this investigation. Both petrographic and WD-XRF analysis requires rather large samples of material for destructive analysis. Experience in the field have shown that around 6cm³ of raw material is required in order to obtain a suitable sample for the creation of thin sections, 2g of powdered material and 2cm³ of reference material. It was possible to obtain the necessary samples from objects excavated at the S. Anna extra urban sanctuary, these objects include pan and cover tiles as well as ridge tiles and sima fragments.

The large samples required for analysis using petrography and WD-XRF makes these methods unsuitable for the study of museum objects. A recent development in archeometric studies is the use of a handheld XRF (HH-XRF) device on archaeological material. As discussed in chapter 3, the HH-XRF closely match the pure measuring capabilities of conventional laboratory based XRF technology, but as this is a new technology, a scientifically robust methodology or interpretative framework for these tools has not yet been established and a number of concerns are currently being investigated by specialists in the field.² The two main concerns of relevance to

this study centres on the calibration of data³ and the use of HH-XRF on non-homogenous material.

⁴ The HH-XRF measures elements as a spectrum range that indicates the relative presence of an element in the sample. The spectral data can be expressed as counts per second. This means that the results are qualitative, since it provides an indication of which material is the most or least counted. In order to calculate quantitative data it is necessary to calibrate the data. To date the recommended calibration file was one provided by the manufacturer and based on mudrock samples. A recent study by Hunt and Speakman, however, have demonstrated that the mudrock calibrations are less reliable for archaeological ceramics and that custom calibration based on certified reference material (CRM) of a similar matrix provides more accurate results.⁵ This study will therefore calibrate the HH-XRF based on 6 CRM samples. The reliability of this custom calibration can be tested on the objects from S. Anna that were measured with both HH-XRF and WD-XRF as the WD-XRF data provide a benchmark for the calibrated HH-XRF data.

The concern regarding non-homogenous material is based on the fact that the HH-XRF only measures an area of about 5mm² on an object. Non-homogenous fabrics with large inclusions thus provide a challenge as the inclusions might differ in chemical composition, which will influence the measurements. For the Hunt and Speakman study material was ground down to a homogenous powder, which is the same method used for WD-XRF samples. But this method is not possible for non-destructive analysis. In order to address this concern multiple measurements were taken for each object in order to obtain a more representative reading.

¹ Degryse & Braekmans 2014, p. 191.

² Frahm & Doonan 2013; Hunt & Speakman, 2015; Shackley 2010; Speakman & Shackley 2013.

³ Speakman & Shackley 2013, p. 1437; Shugar & Mass, 2012, pp. 19-28.

⁴ Shugar & Mass 2012, p. 28.

⁵ Hunt & Speakman 2015.

Archeometric methods are most often employed in archaeology in order to establish provenance.⁶ Provenance testing is based on the "Provenance Postulate" as formulated by Wiegand et al in 1977 and which is described in greater detail in chapter 3. In short, the postulate is based on the fact that the raw material from different geographic locations differs in terms of chemical composition. In theory it is therefore possible to both distinguish between objects made from different sources as well as to link these different groups to geographic locations by identifying characteristic chemical compositions. The aim of this investigation is thus the identification of different population groups in the objects from Akragas as well as the identification of possible imports by comparing these population groups with the published chemical composition of objects associated with different locations in Sicily.

4.3.1 PETROGRAPHIC ANALYSIS

Petrology is a widely used and established method for the study of ceramic materials. The method relies on thin sections of material that are placed between glass plates and polished before observation under a polarized microscope. By viewing the material under different polarized light conditions it is possible to identify minerals such as commonly encountered Kaolinite and K-feldspar based on characteristic optical properties. This method provides the mineralogical composition of both the clay matrix as well as the inclusions. It is also possible to gain information regarding manufacturing processes, such as the temperature at which objects were fired. By establishing characteristic mineralogical components it is thus possible to identify groups of objects that are related in regards to the raw mineral sources used and the methods of manufacture.⁷ Based on the

mineralogical characteristics observed through this method it was possible to identify 3 population groups in a collection of 12 roof tile samples from the S. Anna excavation.

4.3.1.1 PETROGRAPHIC GROUP A

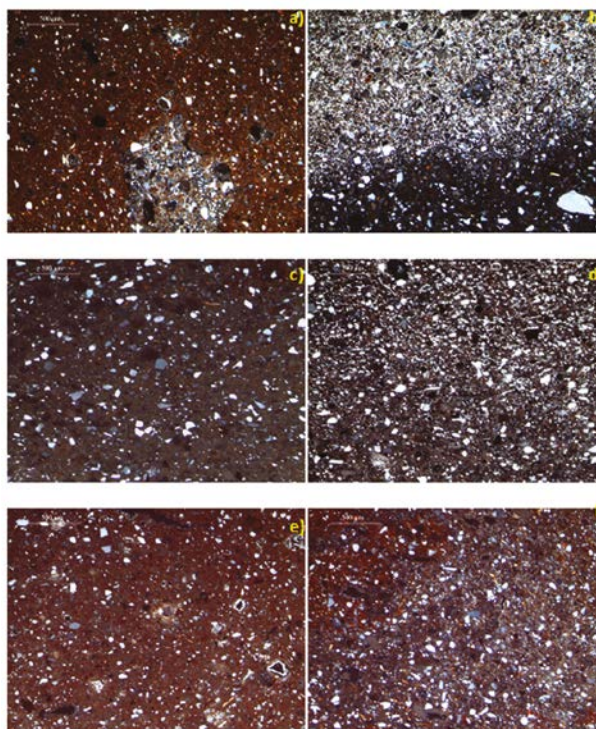


Figure 4.3-1: Photomicrographs of Petrographic group A (a: VIN 422, b: VIN 425, c: VIN 430, d: VIN 432, e: VIN 436, f: VIN 437). All photomicrographs are taken under crossed Nicols (XP)

This group is the largest of the three groups identified. It consists of six objects (VIN 422, 425, 430, 432, 436, and 437). The predominant mineral observed is monocrystalline subangular quartz which is accompanied by laths of mostly brown mica (biotite) although less white mica (muscovite) is also present (figure 4.3-1). In rare instances k-feldspars are visible, as is plagioclases as well as mica schist. Grog is visible in VIN 422 (figure 4.3-1.a). All the samples have inclusions which show a close- to single- spaced porphyric related distribution and have a coarse to fine (c:f) ratio of 40:55. The coarser fraction (<0.05 mm) is

⁶ Degryse & Braekmans 2014, p. 191.

⁷ Degryse & Braekmans 2014, p. 193; Orton & Hughes 2013, pp. 162-3; Peterson & Betancourt 2009, p. 2; Williams 1983, p. 301.

exclusively of siliceous composition. Planar and vugh voids are in most cases filled with micritic calcite of secondary origin and occupy around 5% of the visible field (figure 4.3-1.b, d, e and f). The groundmass is inhomogeneous and the micromass is optically active exhibiting a crystallitic and porostriated b-fabric and a green brown colour under crossed polars (XP) and light brown in plane polarized light (PPL).

4.3.1.2 PETROGRAPHIC GROUP A2

This group consists of three fragments, VIN 421, 423 and 427. It is similar to group A except for the presence of microfossils, most likely green algae and foraminifers, in an extent area of the samples (Fig 2a-c).

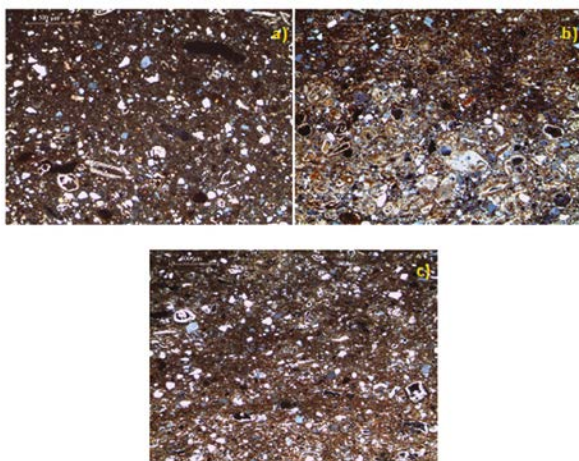


Figure 4.3-2: Photomicrographs of Petrographic group A2 (a: VIN 421, b: VIN 427, c: VIN 423) All photomicrographs are taken under crossed Nicols (XP)

4.3.1.3 PETROGRAPHIC GROUP B

This group consists of three samples (VIN 424, VIN 426, VIN 433). The predominant minerals present in the clay fabric is a subangular to subrounded monocrystalline quartz and the re-deposited micritic calcite (figure 4.3-3.a-c). Plagioclase and k-feldspars are rare to few samples. This group differs from group A and A2 due to the absence of mica. The grain size of coarse fraction lies to the field of fine sand (<0.06 mm) and occupies about

the 30 % of thin section. Porosity is about 5-10% and is represented mainly by vughs and planars. The micromass is characterized by crystallitic and porostriated b-fabric and is slightly active and seems to be sporadically vitrified. Under crossed polars (XP) a dark green micromass is visible, under plane light (PPL) it appears light green brown.

The absence of mica, the green colour of the micromass, the high porosity and the slightly active micromass are characteristics of a higher firing temperature as compared to groups A and A2.

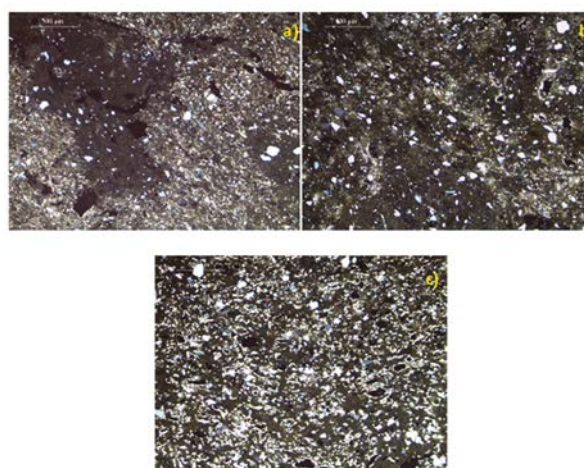


Figure 4.3-3: Photomicrographs of Petrographic group C (a: VIN 424, b: VIN 426, c: VIN 433). All photomicrographs are taken under crossed Nicols (XP)

4.3.2 CHEMICAL COMPOSITION

The current excavation at the extra-urban sanctuary of S. Anna, provided the opportunity for destructive laboratory analysis in order to determine the chemical composition of roof terracottas from Akragas. Samples from a wide range of roof terracotta objects including plain pan and cover tiles, ridge tiles and sima fragments in the canonical Sicilian phase were collected and analysed using WD-XRF. The method used for preparing and measuring the samples are well established in archeometric sciences and are

Table 4.3-1: Chemical composition of roof terracotta elements from the S. Anna excavation as measured by WD-XRF. Major elements only, measurements are given as the weight percentage (wt%)

VIN	Al ₂ O ₃	CaO	Cl	F	Fe ₂ O ₃	K ₂ O	MgO	MnO	Na ₂ O	P ₂ O ₅	SiO ₂	SO ₃	TiO ₂
569	16.744	16.72	0.39		7.48	1.19	3.05	0.07	0.58	0.31	51.65	0.31	1.05
568	17.02	15.20	0.05		8.12	1.30	2.74	0.09	0.61	0.32	52.91	0.17	1.04
564	15.67	14.87	0.06		7.53	1.64	3.28	0.08	0.85	0.38	53.92	0.17	1.04
562	17.76	11.59			8.10	1.38	2.71	0.08		0.30	56.57	0.20	0.98
571	18.00	11.75			7.78	1.32	2.76	0.07	0.01	0.32	56.59	0.13	0.99
567	16.31	15.40			6.77	1.50	2.58	0.08	0.01	0.34	55.68	0.23	0.86
563	17.31	16.80	0.03		7.68	0.55	2.82	0.09	1.13	0.40	51.71	0.08	1.01
421	15.78	15.66	0.07	0.26	6.48	1.24	2.52	0.06	0.45	0.33	55.68	0.12	0.91
422	16.70	10.98	0.06	0.27	6.46	1.59	3.21	0.06	0.73	0.34	58.22	0.13	0.94
423	15.30	16.96	0.09	0.28	6.62	1.50	2.84	0.07	0.68	0.33	53.84	0.23	0.93
424	16.29	15.73	0.02	0.21	6.14	0.47	3.15	0.05	1.47	0.31	54.86	0.12	0.91
425	15.24	16.80	0.03	0.43	6.27	0.95	3.06	0.06	0.73	0.37	54.63	0.21	0.87
426	13.57	18.07	0.01		5.68	1.25	3.10	0.06	1.03	0.27	55.77	0.11	0.80
427	15.60	14.85	0.06		6.92	1.50	2.90	0.06	0.76	0.32	55.49	0.18	0.93
428	16.21	11.53	0.09	0.25	6.75	1.62	3.40	0.07	0.86	0.27	57.60	0.11	0.93
429	14.12	14.80	0.01		5.81	1.11	3.34	0.06	0.90	0.25	58.35	0.16	0.80
430	16.83	10.85	0.03		6.28	1.65	2.89	0.07	0.50	0.28	59.38	0.03	0.93
431	13.25	14.83	0.02		5.95	1.37	2.48	0.05	0.86	0.23	59.85	0.06	0.83
432	16.03	10.51	0.10	0.50	5.94	1.09	2.88	0.07	0.53	0.31	60.73	0.10	0.89
433	14.31	17.98	0.02	0.23	6.48	1.02	3.21	0.07	0.80	0.26	54.39	0.08	0.88
434	16.17	15.49	0.01		6.56	0.81	3.63	0.07	0.92	0.28	54.88	0.03	0.89
436	16.58	10.04	0.07	0.63	6.46	1.61	3.39	0.06	0.92	0.28	58.69	0.10	0.96

described in Chapter 3. The chemical composition of these samples are provided below. Major elements in ceramic materials are characterized by a low atomic number (or Z number) which is a reflection of the number of protons in the nucleus of that element. These elements are given as elemental oxides in weight percentage values (wt%). Minor and trace elements have a higher atomic number and are given as elements as measured in parts per million (ppm).⁸ The major and minor elemental composition of the objects from S. Anna are provided below in table 4.3-1 and table 4.3-2 .

The elements measured behave in complex and varied ways during soil formation processes,

firing and post deposition conditions. Certain oxides, or groups of trace elements, are known to be indicative of characteristic soil features that can therefore be related back to the raw sources used for manufacturing. For example: lithophile elements, such as Rb, Sr, Ba and Th are linked to the silicate phases in soils.⁹ In archeometric studies a lot of attention has been given to the identification of oxides and elements which are the most appropriate in evaluating ceramic material as measured by different methods.¹⁰ Since WD-XRF has a long history of use on archaeological material the specific combination of major, minor and trace elements used in analysis is well established.

8 Hunt & Speakman 2015, p. 627.

9 Degryse & Braekmans 2014, p. 194.

10 Degryse & Braekmans 2014; Hunt & Speakman. 2015

Table 4.3-2: Chemical composition of roof terracotta elements from the S. Anna excavation as measured by WD-XRF. Minor and trace elements measurements are given as parts per million (ppm) 149

VIN	Ba	Ce	Cr	Cu	Nb	Ni	Pb	Rb	Sr	Y	Zn	Zr
569	2265.21		233.84	125.18			68.12	76.55	934.25		174.27	891.53
568	1942.89		233.84	112.66	57.22	165.43	87.58	87.49	1028.86		174.27	769.96
564	2498.00		219.23		42.92	190.88	48.66	120.30	1289.03		186.72	796.97
562	1128.13		379.99		57.22	127.25	38.92	109.36	827.82		211.62	851.00
571	1011.73		277.69			165.43	48.66	76.55	827.82		186.72	648.38
567	581.97		204.61	87.63			58.39	109.36	1123.47		149.38	729.43
563	1450.45		219.23			203.60	38.92	229.66	1218.08		136.93	864.51
421	2417.42		233.84	62.59	42.92	63.63	38.92	76.55	863.30	50.80	149.38	634.88
422	1459.40		219.23	75.11	28.61	127.25	29.19	76.55	603.13	25.40	112.03	540.32
423	1289.29		219.23	62.59	28.61	114.53	58.39	87.49	815.99	38.10	161.82	675.40
424	850.57		277.69	112.66	28.61	101.80		32.81	993.38	38.10	87.14	580.84
425	1325.10		263.07	75.11	42.92	127.25	29.19	54.68	910.60	38.10	112.03	688.91
426	537.20	491.36	233.84	75.11	42.92	76.35		65.62	934.25	38.10	136.93	580.84
427	1862.31		321.53		42.92	114.53		87.49	863.30	50.80	149.38	675.40
428	1360.92		277.69		57.22	127.25	38.92	98.42	638.60		199.17	553.83
429	447.67	515.93	248.46	87.63	28.61	114.53		54.68	721.39	38.10	112.03	580.84
430	922.20		263.07	100.14	128.75	76.35	29.19	54.68	685.91	38.10	112.03	594.35
431	635.69		190.00		42.92	101.80		87.49	733.21	25.40	149.38	769.96
432	1486.26		263.07	50.07	28.61	101.80	48.66	32.81	685.91	38.10	112.03	634.88
433	805.81		204.61		42.92	114.53		65.62	1040.69	38.10	136.93	783.46
434	805.81		292.30	62.59	42.92			32.81	886.95	25.40	161.82	634.88
436	752.09		131.54	62.59	42.92	89.08	29.19	76.55	532.17	38.10	149.38	499.80
437	1226.62		219.23	62.59	28.61	89.08	29.19	43.74	603.13	38.10	124.48	607.86

The standard elements used for analysis in these publications are Na₂O, MgO, Al₂O₃, SiO₂, P₂O₅, K₂O, CaO, TiO₂, MnO, Fe₂O₃, V, Cr, Co, Ni, Zn, Rb, Sr, Y, Zr, Nb, Ba, La and Ce.¹¹ As can be seen in table 4.3-2 V, Co and La were not detected in the WD-XRF analysis of the S. Anna objects, and will therefore not be included in this analysis.

The ratio between key elements is useful as a first step identifier of patterning in the dataset and is frequently used by scholars.¹² The relationship between major elements, given as oxides, are shown in as pairwise plots in figure 4.3-4 and the minor

elements in figure 4.3-5. The petrographic groups are shown in these plots in order to evaluate the first groupings that have been identified in the data set. It appears that group A can be distinguished from group A1 and B due to lower levels of CaO and higher levels of Al₂O₃ and SiO₂. There is one fragment (VIN 425) from group A, however, which consistently plot with group A1 and B. Group A2 is distinguished by higher levels of Rb and lower levels of SiO₂. While there is considerable overlap between group A2 and B in especially in regards to CaO and SiO₂, group B can nevertheless be distinguished from group A2 by higher levels of Sr and lower levels of Al₂O₃. A number of the pairwise plots show linear groupings (e.g MnO, Y, Nb and Ce). This is related to the detection limit of the instrument for these elements. For example,

11 Aquilia, et al. 2011; Aquilia, et al. 2012; Barone, et al. 2011; Barone, et al. 2005; Belfiore, et al. 2010.

12 Aquilia, et al. 2015, fig 4; Aquilia, et al. 2012, p. 446, fig 2; Barone, et al. 2005, p. 753, fig 3; Belfiore, et al. 2010, fig 7.

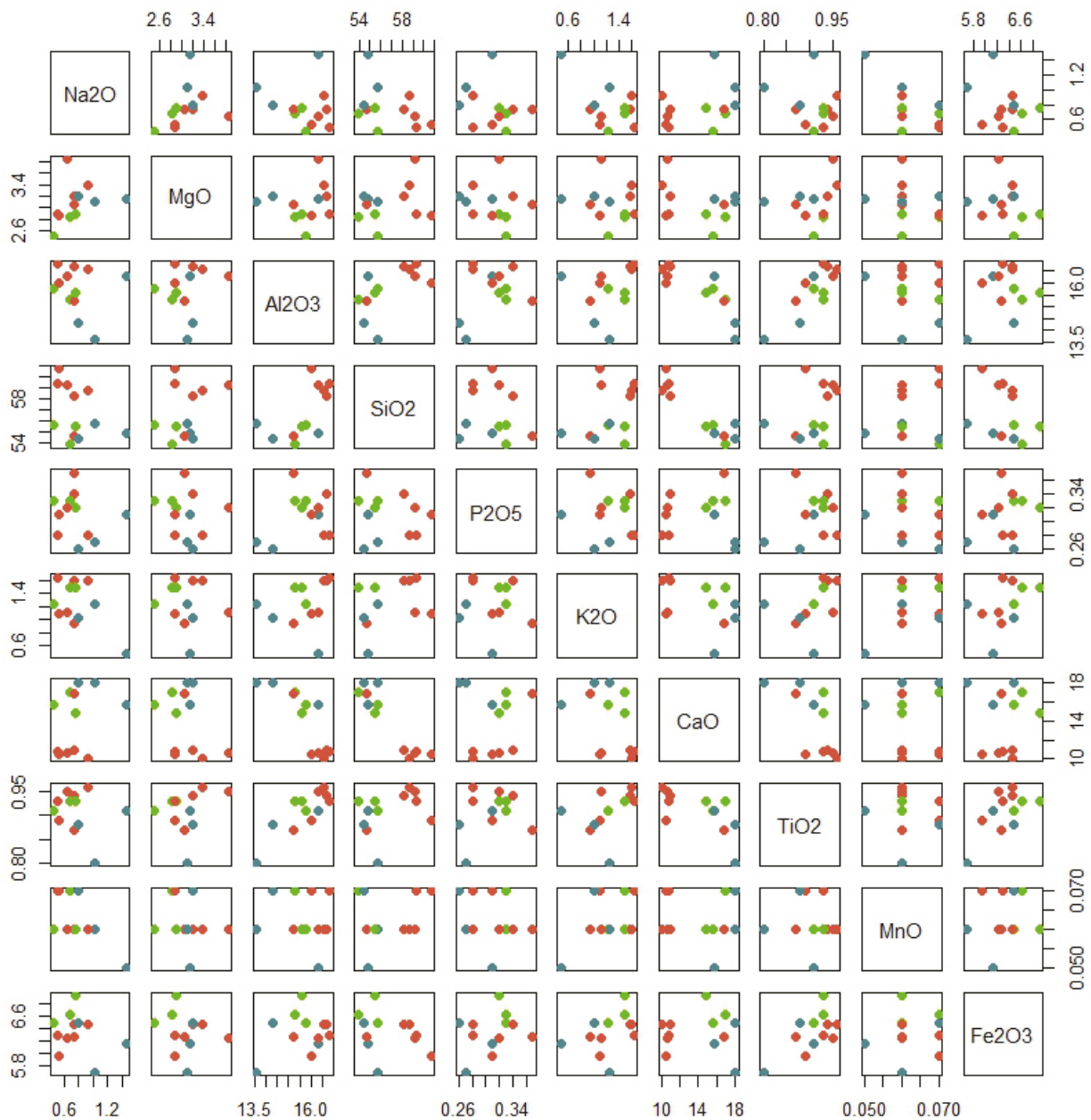


Figure 4.3-4: Pairwise plots of major elements according to groups identified in petrographic analysis (Red: group A, Green: group A2, Blue: Group B)

the objects from S.Anna have very low values of Y (table 4.3-2). The wt% of the oxide (Y_2O_3) as measured by the WD-XRF is between 0.002 and 0.004%, which explains why there are only three different values for Y in the data set when converted to ppm. The differentiation in the data for Y shown below is thus overinflated. While the same condition also applies to Niobium (Nb). There is a clear outlier in group A in regards to Nb, VIN 430 has almost 3 times the levels than other objects in the same group. A closer look at the relationship between key elements identified in the figures 4.3-

4 and 4.3-5 is shown in figure 4.3-6.

Trace elements are often used as indicators of provenance. Th, Sc, Zr, Y, and Nb are considered to be some of the more useful trace elements since they are the least soluble and mobile, which means they are resistant to weathering and alteration. For this reason this group of elements are good indicators of raw clayey sources.¹³ Th is not detected in the dataset. But the relationship between these remaining elements are provided in figure 4.3-5.

¹³ Degryse & Braekmans 2014, p. 195.

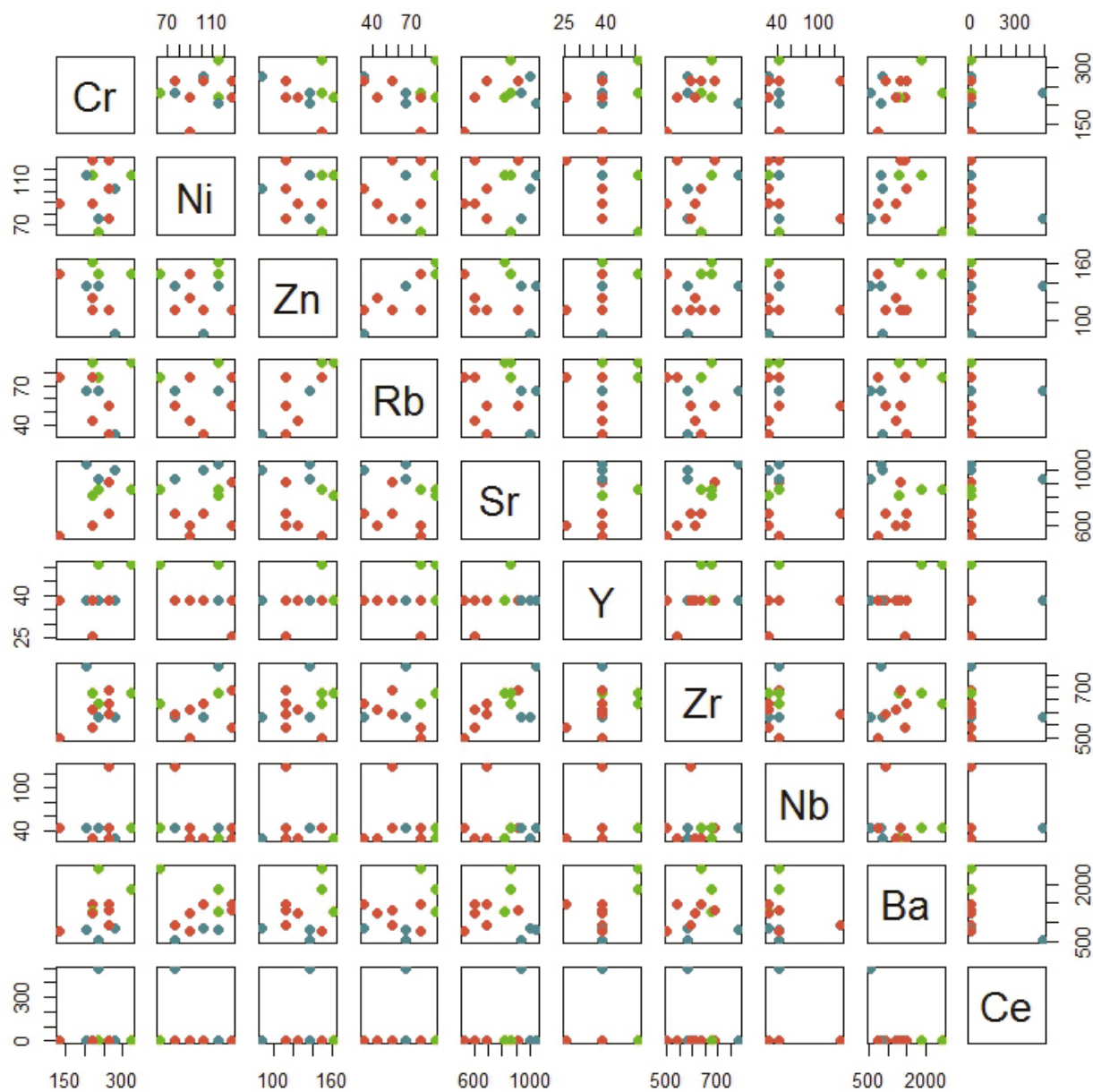


Figure 4.3-5: Pairwise plots of minor elements according to groups identified in petrographic analysis (Red: group A, Green: group A2, Blue: Group B)

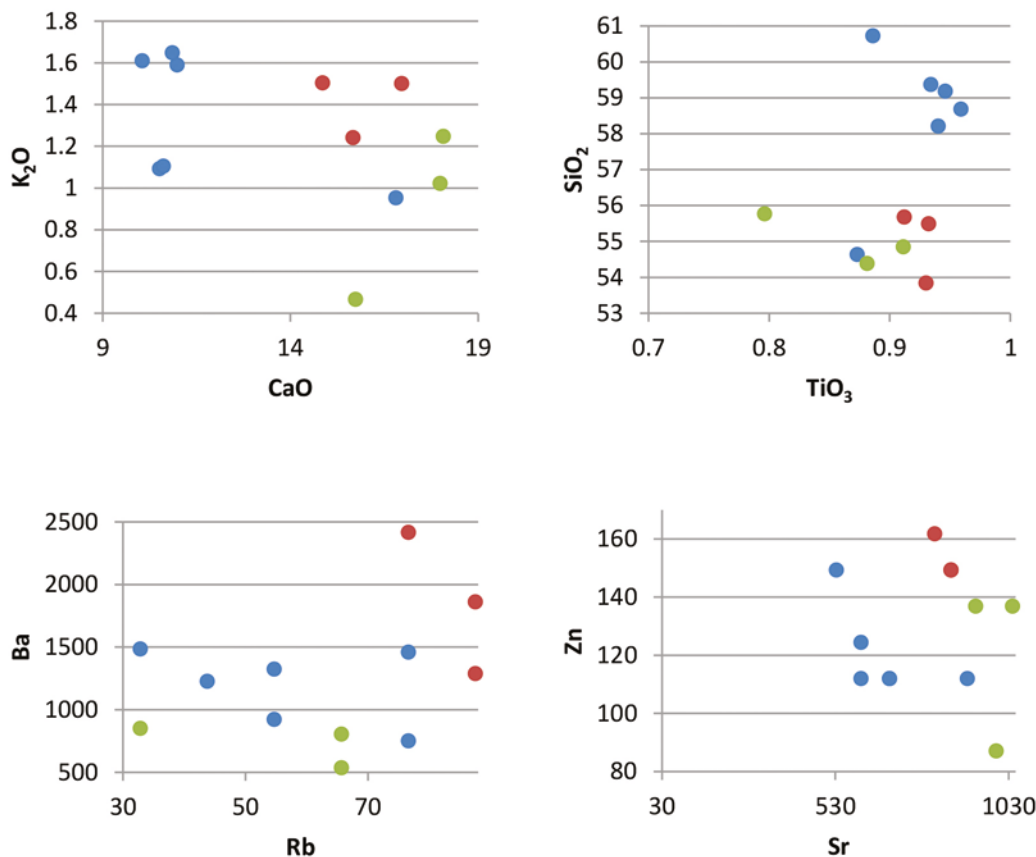


Figure 4.3-6: Individual pairwise plots of key major and minor elements, according to groups identified in petrographic analysis (Red: group A, Green: group A2, Blue: Group B)

Apart from Barium (Ba) there does not seem to be a clear differentiation in the different petrographic groups according to these trace elements.

4.3.2.1 PRINCIPLE COMPONENT ANALYSIS OF PETROGRAPHIC GROUPS

The pairwise plots in the preceding section are a valuable first step in evaluating the dataset, but there are a number of limitations. It is only possible to evaluate 2 values against each other on a graph and the difference between elements with high concentrations against elements with low concentrations can distort the dataset. A statistical method of analysis which is widely used in these circumstances is principle component analysis which is discussed in greater detail in Chapter 3. In essence it is a method by which a large number of variables are reduced to a much smaller set of variables, or principle components. These principle components still reflect the major patterns found in

the original data. This is done by finding variables with a strong correlation that as a group seems to respond to the same condition and as such can be expressed as a single variable.¹⁴ A summary of the principle component analysis performed on the same objects used for the petrographic analysis is provided below in table 4.3-3, which indicates the level of influence that each component has on the data set, for example, component 1 accounts for 29% of the variance.

The composition of each component can be expressed by calculating the loading of each original variable according to each component. The loading is provided in table 4.3-4. For the first component Al_2O_3 , SiO_2 , TiO_2 , and Fe_2O_3 have the highest negative loading (> -0.35) while CaO and Sr have the highest positive loading (> 0.25). This means that there is a positive correlation

¹⁴ Drennan 2009, p. 300.

Table 4.3-3: Summary of Principle component analysis performed WD-XRF data for objects from S. Anna that were also used in the petrographic analysis. The first 8 components are shown, which collectively account for 97% of the variance in the data.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
Standard deviation	2.36	2.08	1.56	1.46	1.27	1.19	0.77	0.64
Proportion of variance	0.29	0.23	0.13	0.11	0.09	0.07	0.03	0.02
Cumulative proportion	0.29	0.52	0.65	0.76	0.85	0.92	0.95	0.97

Table 4.3-4: The loading of each major and minor element within each principle component.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
Na ₂ O	-0.09	0.26	-0.45	-0.11	-0.24	-0.11	0.08	-0.16
MgO	-0.32	0.10	-0.30	0.05	0.02	0.07	0.21	-0.23
Al ₂ O ₃	-0.40	0.03	0.10	0.10	-0.13	-0.03	-0.06	0.20
SiO ₂	-0.36	0.02	-0.03	0.26	0.01	0.05	0.37	0.04
K ₂ O	-0.01	-0.46	0.01	-0.02	0.16	-0.12	0.20	-0.14
CaO	0.29	0.27	-0.21	-0.06	-0.03	0.12	0.15	0.42
TiO ₂	-0.41	0.00	-0.01	0.04	-0.11	0.13	-0.15	0.12
MnO	-0.11	-0.13	-0.04	0.34	0.55	0.20	0.09	0.16
Fe ₂ O ₃	-0.36	0.01	-0.06	-0.12	-0.12	0.21	-0.50	0.08
Cr	0.07	0.31	0.35	0.13	0.03	-0.26	0.21	-0.36
Ni	-0.12	0.20	-0.10	-0.38	0.42	-0.13	-0.23	-0.34
Zn	0.11	-0.33	-0.18	-0.08	-0.04	0.48	0.22	-0.10
Rb	0.18	-0.34	-0.16	-0.32	-0.06	-0.06	-0.08	0.15
Sr	0.25	0.36	-0.11	0.10	-0.03	0.07	-0.03	0.26
Y	0.14	0.04	0.16	0.28	-0.44	0.43	-0.04	-0.36
Zr	0.13	0.26	0.03	0.15	0.42	0.38	-0.23	-0.03
Nb	0.07	-0.17	0.01	0.49	-0.07	-0.41	-0.30	0.17
Ba	0.00	-0.04	0.57	-0.25	-0.02	0.19	-0.12	0.02

between Al₂O₃, SiO₂, TiO₂, and Fe₂O₃, and between CaO and Sr, but Al₂O₃, SiO₂, TiO₂, and Fe₂O₃ have a negative correlation with CaO and Sr. But as already mentioned the first component only accounts for 29% of the variance seen in the data and the other components also need to be taken into consideration.

A way of expressing the relationship between two components graphically is by using a biplot. The biplot for principle components 1 and 2 is provided in figure 4.3-7, and component 2 and 3 in figure 4.3-8. Group A, as identified in the petrographic analysis, is characterized by high levels of Al₂O₃, SiO₂, TiO₂, and Fe₂O₃, Group A2 by high levels of

Rb and Zn. Group B is characterized by high levels of Sr and CaO.

On closer inspection of these two biplots it becomes that the objects in petrographic group A have one outlier which falls outside the 68% confidence level. This indicated that the object differs by more than one standard deviation from the mean. In order to evaluate the variation the relative standard deviation (also known as the coefficient of variance) for each element according to the petrographic groups were calculated and are visible in Table 4.3-5.

There are a number of possible reasons for the variance seen in a number of major and minor

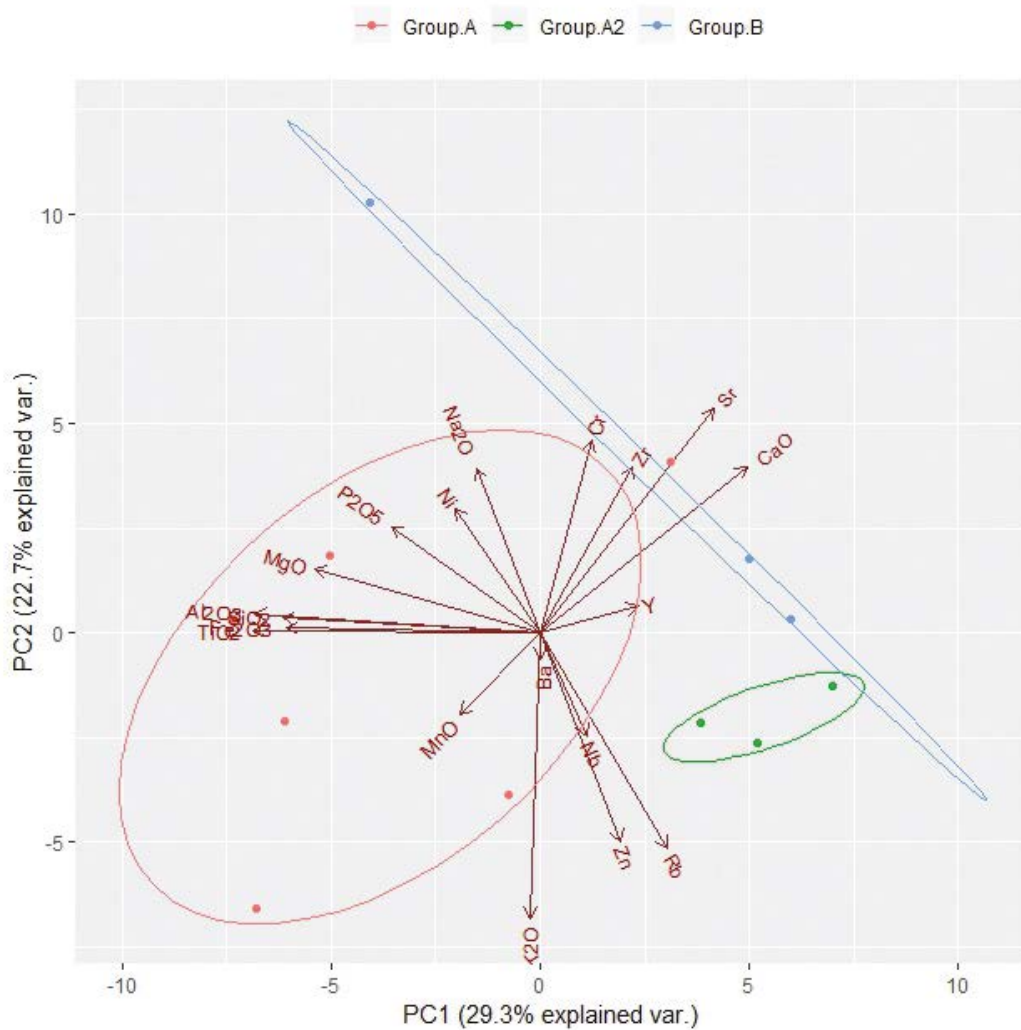


Figure 4.3-7: Biplot of principle component 1 and 2 calculated for chemical composition of the petrographic groups as measured by WD-XRF. The ellipse indicates a 68% fit for each group.

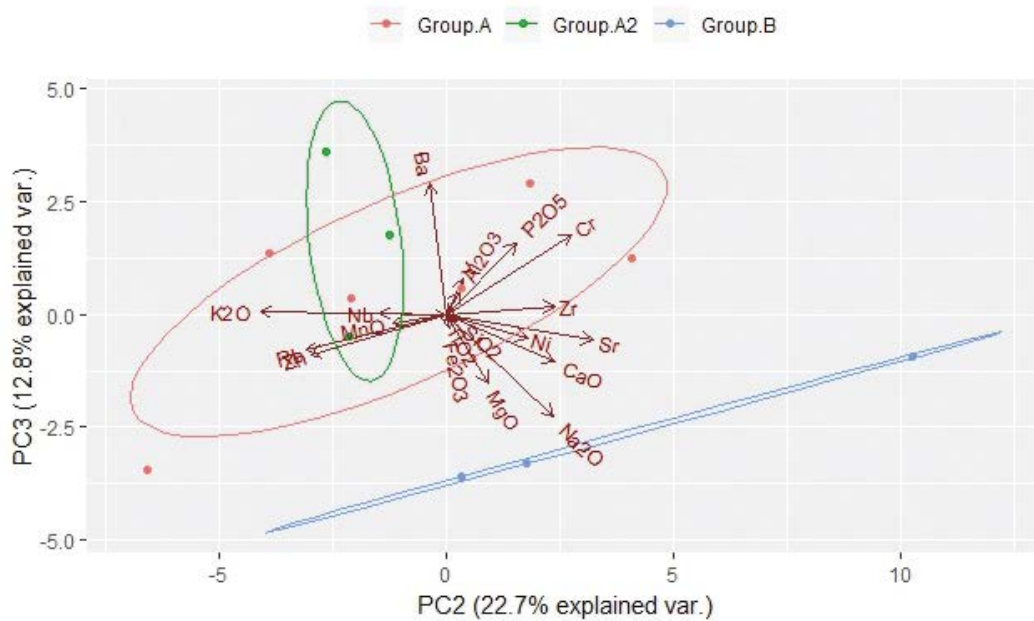


Figure 4.3-8: Biplot of principle component 2 and 3 calculated for chemical composition of the petrographic groups as measured by WD-XRF. The ellipse indicates a 68% fit for each group.

Table 4.3-5: The relative standard variation of each major and minor element according to petrographic group 155

	Group A	Group A2	Group B	Average
	RSD%	RSD%	RSD%	
	n=6	n=3	n=3	
Na ₂ O	22.7	25.5	31.1	26.4
MgO	11.4	7.3	1.8	6.8
Al ₂ O ₃	3.6	1.6	9.6	4.9
SiO ₃	3.5	1.8	1.3	2.2
K ₂ O	23.6	10.6	44.1	26.1
CaO	22.0	6.7	7.7	12.1
TiO ₂	3.8	1.2	6.9	4.0
MnO	5.0	14.5	19.6	13.1
Fe ₂ O ₃	3.0	3.4	6.6	4.4
Cr	22.6	21.4	15.4	19.8
Ni	20.9	30.1	19.9	23.7
Zn	12.5	4.7	23.9	13.7
Rb	31.0	7.5	34.6	24.4
Sr	19.6	3.2	5.4	9.4
Y	14.4	15.7		15.1
Zr	11.3	3.5	18.0	11.0
Nb	78.2	21.7	21.7	40.5
Ba	24.9	30.4	23.2	26.2
Average	18.2	11.2	16.7	

elements in table 4.3-5. It should be noted that the groups are based on petrographic groups and the sample sizes are fairly small. The presence of subgroups cannot be discounted. This matter will receive more attention in in the next section. The purpose of this analysis is to identify elements which might show a high degree of variance which can be attributed to weathering conditions. It has already been noted in the pairwise plots in figure 4.3-4 and figure 4.3-6 that there is one object in group A which consistently plot as an outlier. This is confirmed by the biplots of the principle components 1:2 and 2:3 in figure 4.3-7 and figure 4.3-8. This object can be identified as VIN 425 due to high levels of CaO and Sr. But it is also possible that the weathering conditions while deposited in the soil is affecting specific elements and is causing the variance. Both Na₂O and Ba both show high variance among all three groups. In a recent study on find grain pottery from Lentini, Messina and

Syracuse the authors found that these two elements also exhibited high variance and they linked it to high mobility of these elements during burial.¹⁵ K₂O, Ni, Rb and Ce also show a high overall RSD, but on closer inspection it is apparent that this figure is strongly influenced by a high RSD in either Group A2 or B. A high variation in these two groups might be associated with subgroups, and not weathering. In contrast Nb has a very high RSD, which is seen predominantly in petrographic group A. This variance cannot be attributed to the influence of the outlier already identified as VIN 425 have the same Nb concentration as other objects in the group. Instead, the variance in Nb might instead be attributed to the low detection limit of the instrument, which has already been discussed by hand of figure 4.3-5. Three elements have thus been identified that show a higher than average variation. Na₂O₃ and Ba are known to be

15 Barone, et al. 2005, p. 754.

affected by local weathering conditions. And while the weathering conditions for Nb is not known it shows a very high variance that can potentially skew the data. For this reason Na₂O₃, Ba and Nb will be excluded from further analysis.

By using principle component analysis in order to evaluate the chemical composition of the petrographic groups already identified, elements which have the greatest influence on the patterning of the dataset were thus identified. The analysis also identified elements which are more susceptible to local weathering conditions and as such cause a higher level of variance in the dataset. This information is relevant to the subsequent analysis of a wider range of objects from S. Anna, as the same weathering conditions are applicable to these objects. The petrographic analysis and subsequent principle component analysis, as detailed above, is limited to samples taken from the S. Anna excavation in 2015. During 2016 a second group of objects were uncovered but due to time constraints were only analysed using WD-XRF and not petrography as well.

4.3.2.2 MULTIVARIATE ANALYSIS OF ALL WD-XRF DATA

In the preceding section the principle components have thus been identified in regards to the chemical composition of the 3 petrographic groups previously identified and checked for their consistency. During this analysis a group of elements (Na₂O, Ba, Nb) are identified as elements which might cause distortion of the statistical results since they appear to be more affected by local weathering conditions and/or instrument detection limitations. In addition, the analysis also suggests the potential for subgroups within the main petrographic groups. These subgroups are difficult to identify due to the small sample sizes involved. The larger collection of objects from the S. Anna that were analysed using the WD-XRF (table 4.3-1 and table 4.3-2) therefore requires consideration regarding to two aspects. The first is

to identify objects which are related to the groups already identified in the dataset, and the second is to investigate the possible presence of subgroups.

In order to evaluate the similarity of different objects by using multiple variables of different magnitudes a multivariate statistical analysis is the most appropriate and widely used method. The first step of this analysis involves transforming the data using the central log-ration (section 3.4). The similarity between objects is then calculated as the Euclidian distance between each object. The results are shown below in table 4.3-6. The lowest value is between VIN 430 and VIN 422, which means these two are the most similar, while VIN 429 and VIN 563 is the least similar. The second step uses the Euclidian distance in order to group the data according to similarity by applying hierarchical cluster analysis. This method expresses potential groups by visually indicating the links between different objects as a dendrogram. Objects with the shortest linkage are thus the most similar. The dendrogram for the WD-XRF data is provided in figure 4.3-9.

The dendrogram in figure 4.3-9 shows 5 groups of objects. The grouping is formed at a linkage distance of 6. The objects from petrographic group A2 all fall within group 3 (VIN 421, 423, 427). The objects which make up petrographic group A all fall within group 4 except for VIN 425, which falls in group 5. This fragment had already been identified as an outlier in the preceding analysis. The objects of petrographic group B all fall within group 5 (VIN 424, 433) except for VIN 426 which is in group 3. Therefore, with the exception of VIN 425 and 426, the chemical composition of the three petrographic groups support the presence of three groups. The other objects from S. Anna which were not part of the petrographic analysis comprise two groups, 1 and 2, with VIN 563 as an outlier. A possible reason for the separation between group 1 and 2 with the rooftop objects in groups 3-5 is discussed in section 5.1.2.

Table 4.3-6: Euclidian distance between clr normalized WD-XRF results for objects from S. Anna

437	436	434	433	432	431	430	429	428	427	426	425	424	423	422	421	563	567	571	562	564	568	569	
6.7	7.4	5.9	5.9	6.9	8.0	6.7	8.2	6.2	5.4	7.7	5.6	7.7	4.4	6.7	4.7	6.7	5.4	5.8	6.0	4.9	4.1		569
7.2	7.4	7.2	6.4	6.8	8.6	6.6	8.6	5.9	5.9	8.4	5.9	8.4	4.2	6.5	5.5	5.4	5.8	4.4	5.2	3.6		4.1	568
7.1	7.3	7.2	5.8	7.3	8.0	7.0	8.1	5.5	5.2	7.7	5.9	8.2	4.6	6.4	5.7	5.5	6.6	5.7	6.3		3.6	4.9	564
7.3	8.0	7.0	7.3	6.6	8.2	6.0	8.3	5.4	5.3	8.7	6.7	9.0	5.9	6.8	6.3	7.5	6.1	3.3		6.3	5.2	6.0	562
5.6	5.8	6.3	6.3	5.1	7.2	4.5	7.0	4.2	4.7	7.5	5.5	7.6	4.5	4.8	5.0	7.3	5.2		3.3	5.7	4.4	5.8	571
6.6	6.5	5.9	5.2	5.7	6.2	5.0	6.5	6.1	5.7	5.9	5.1	7.8	4.0	6.0	4.6	7.5		5.2	6.1	6.6	5.8	5.4	567
8.8	9.1	8.2	6.6	8.7	9.1	8.7	9.1	7.9	7.2	8.7	6.7	8.1	6.4	8.2	7.5		7.5	7.3	7.5	5.5	5.4	6.7	563
5.4	5.7	5.4	4.8	4.2	5.1	4.4	5.5	4.8	3.3	5.1	3.5	5.9	3.2	4.3		7.5	4.6	5.0	6.3	5.7	5.5	4.7	421
2.8	2.7	5.5	5.5	3.1	5.5	2.3	4.4	3.3	4.0	5.5	4.3	5.8	4.3		4.3	8.2	6.0	4.8	6.8	6.4	6.5	6.7	422
5.2	5.1	5.1	3.8	4.8	5.3	4.4	5.2	4.0	3.7	4.7	3.2	6.3		4.3	3.2	6.4	4.0	4.5	5.9	4.6	4.2	4.4	423
5.6	6.8	4.6	4.8	5.7	6.3	6.1	4.4	6.8	5.3	4.6	3.9		6.3	5.8	5.9	8.1	7.8	7.6	9.0	8.2	8.4	7.7	424
4.5	5.8	4.0	2.6	4.0	4.9	4.4	3.5	5.0	3.4	3.5		3.9	3.2	4.3	3.5	6.7	5.1	5.5	6.7	5.9	5.9	5.6	425
5.7	6.0	4.5	3.2	5.6	3.8	5.6	2.5	5.8	4.7		3.5	4.6	4.7	5.5	5.1	8.7	5.9	7.5	8.7	7.7	8.4	7.7	426
5.1	5.8	4.7	4.3	4.7	5.1	4.2	4.8	3.9		4.7	3.4	5.3	3.7	4.0	3.3	7.2	5.7	4.7	5.3	5.2	5.9	5.4	427
3.9	3.9	5.0	5.7	4.5	6.1	3.9	5.2		3.9	5.8	5.0	6.8	4.0	3.3	4.8	7.9	6.1	4.2	5.4	5.5	5.9	6.2	428
4.2	5.1	4.5	3.9	4.3	3.9	4.6		5.2	4.8	2.5	3.5	4.4	5.2	4.4	5.5	9.1	6.5	7.0	8.3	8.1	8.6	8.2	429
3.5	3.8	5.2	5.6	2.5	5.5		4.6	3.9	4.2	5.6	4.4	6.1	4.4	2.3	4.4	8.7	5.0	4.5	6.0	7.0	6.6	6.7	430
6.2	5.8	6.5	4.5	5.3		5.5	3.9	6.1	5.1	3.8	4.9	6.3	5.3	5.5	5.1	9.1	6.2	7.2	8.2	8.0	8.6	8.0	431
3.3	4.7	5.4	5.6		5.3	5.3	2.5	4.3	4.5	4.7	5.6	4.0	5.7	4.8	4.2	8.7	5.7	5.1	6.6	7.3	6.8	6.9	432
5.4	6.1	4.1		5.6	4.5	5.6	3.9	5.7	4.3	3.2	2.6	4.8	3.8	5.5	4.8	6.6	5.2	6.3	7.3	5.8	6.4	5.9	433
4.4	6.0		4.1	5.4	6.5	5.2	4.5	5.0	4.7	4.5	4.0	4.6	5.1	5.5	5.4	8.2	5.9	6.3	7.0	7.2	7.2	5.9	434
3.3		6.0	6.1	4.7	5.8	3.8	5.1	3.9	5.8	6.0	5.8	6.8	5.1	2.7	5.7	9.1	6.5	5.8	8.0	7.3	7.4	7.4	436
	3.3	4.4	5.4	3.3	6.2	3.5	4.2	3.9	5.1	5.7	4.5	5.6	5.2	2.8	5.4	8.8	6.6	5.6	7.3	7.1	7.2	6.7	437

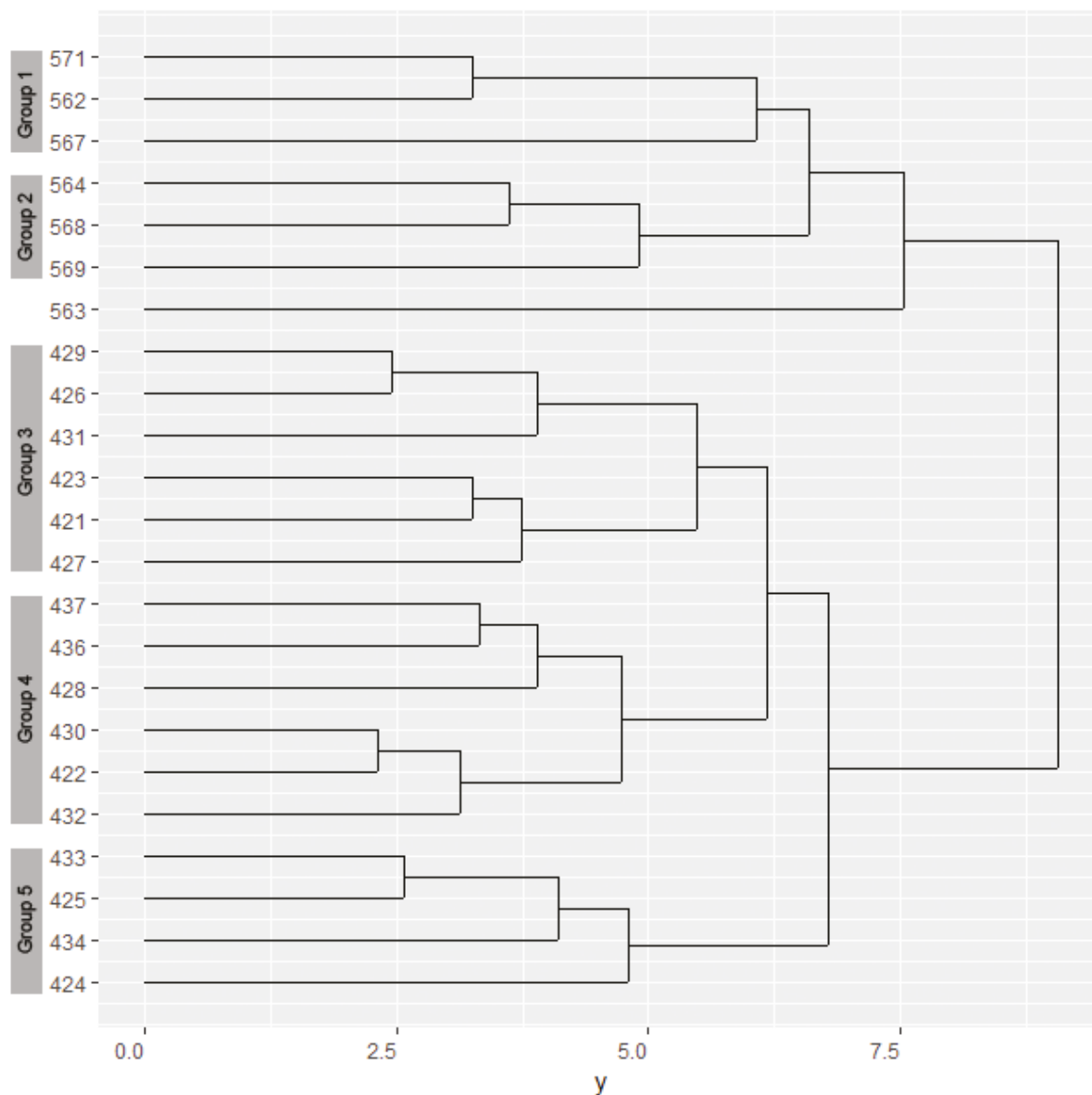


Figure 4.3-9: Dendrogram of WD-XRF data for objects from S. Anna. The standardized Euclidian distance is expressed through complete clustering, the groups were discriminated at a linkage distance of 6.

4.3.2.3 PRINCIPLE COMPONENT ANALYSIS OF COMPLETE ASSEMBLAGE WD-XRF DATA

The main factors which influence the grouping of objects in the multivariate analysis above (figure 4.3-9) can once again be determined through principle component analysis. This time the first two components collectively account for 80 % of the variance in the dataset (table 4.3-7). The first component is characterized by a negative loading for SiO₂, TiO₂, Al₂O₃, Fe₂O₃, MnO, and CaO (<

-0.28). Component 2 show a high loading for Na₂O (>0.30) and a low loading for Pb (< -0.30) (table 4.3-8).

The results from the principle component analysis is visualized with a biplot of the first two components (figure 4.3-10). The 5 groups identified in the multivariate analysis (figure 4.3-9) are indicated by colour and the 68% confidence margin is shown as an ellipse. Group 1 is distinguished by higher levels of Pb and Rb. Group 2 have slightly lower levels of Pb and Rb, and higher levels of Na₂O. Group 3-5

Table 4.3-7: Summary of Principle component analysis performed on all the WD-XRF data for objects from S.Anna. The first 8 components are shown, which collectively account for 99% of the variance in the data.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
Standard deviation	3.43	1.32	1.09	0.87	0.76	0.69	0.37	0.30
Proportion of variance	0.69	0.10	0.07	0.04	0.03	0.03	0.01	0.01
Cumulative proportion	0.69	0.80	0.87	0.91	0.95	0.97	0.98	0.99

Table 4.3-8: The loading of each major and minor element within each principle component.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8
SiO ₂	-0.28	0.11	0.10	0.20	-0.02	-0.03	0.03	-0.32
TiO ₂	-0.29	0.03	-0.02	0.09	0.02	-0.06	0.17	-0.14
Al ₂ O ₃	-0.28	0.01	0.02	0.17	0.07	-0.13	0.23	-0.28
Fe ₂ O ₃	-0.29	-0.04	0.03	0.01	0.08	-0.04	0.16	0.00
MnO	-0.28	-0.11	0.01	0.06	-0.04	-0.23	0.01	0.42
MgO	-0.27	0.16	0.01	0.23	-0.08	-0.11	0.27	0.02
CaO	-0.28	0.13	-0.03	-0.18	-0.02	-0.12	-0.46	-0.02
Na ₂ O	-0.02	0.61	-0.40	-0.09	-0.52	-0.02	0.09	0.05
K ₂ O	-0.21	-0.12	0.24	0.33	-0.39	0.64	-0.37	-0.12
Sr	-0.27	0.02	-0.05	-0.27	0.13	-0.21	-0.49	0.07
Cr	-0.27	0.04	0.01	0.14	0.41	0.05	0.09	-0.14
Ni	0.18	0.39	0.39	-0.15	0.41	0.26	0.02	0.08
Zn	-0.27	-0.15	0.08	-0.03	-0.06	0.24	0.24	0.70
Rb	-0.17	-0.25	0.26	-0.72	-0.29	0.10	0.31	-0.28
Zr	-0.28	-0.03	-0.01	-0.14	0.09	-0.08	-0.22	0.00
Ba	-0.11	-0.15	-0.72	-0.16	0.30	0.49	0.06	-0.07
Pb	0.19	-0.53	-0.15	0.19	-0.13	-0.25	-0.04	-0.07

have higher levels of Na₂O and Ni, with groups 3 and 5 distinguished from group 4 by higher levels of SiO₂, TiO₂, Al₂O₃, Fe₂O₃, MgO and CaO.

4.3.3 HH-XRF

As discussed in chapter 3, the use of handheld XRF technology for the analysis of terracotta objects is challenging and its application frequently discussed. The major concerns relate to the calibration of spectral data and the heterogeneous nature of terracotta fabric. In the study by Hunt and Speakman it was demonstrated that the use of calibration functions derived from regression equations based of certified reference materials (CRM) provide results that correspond more

closely with the certified values, especially compared to data based on the manufacturers supplied mudrock calibration for use with ceramic materials.¹⁶ In this study the samples were ground down to a homogenous powder, which greatly addresses the concern regarding heterogeneous material. With this method, however, is not possible when analysing museum objects, as it requires the destructive analysis of a relatively large sample. The use of non-destructive analysis of objects using handheld XRF technology remains a problem that needs to be addressed. The following section will describe the steps taken in calibrating

¹⁶ Hunt & Speakman 2015.

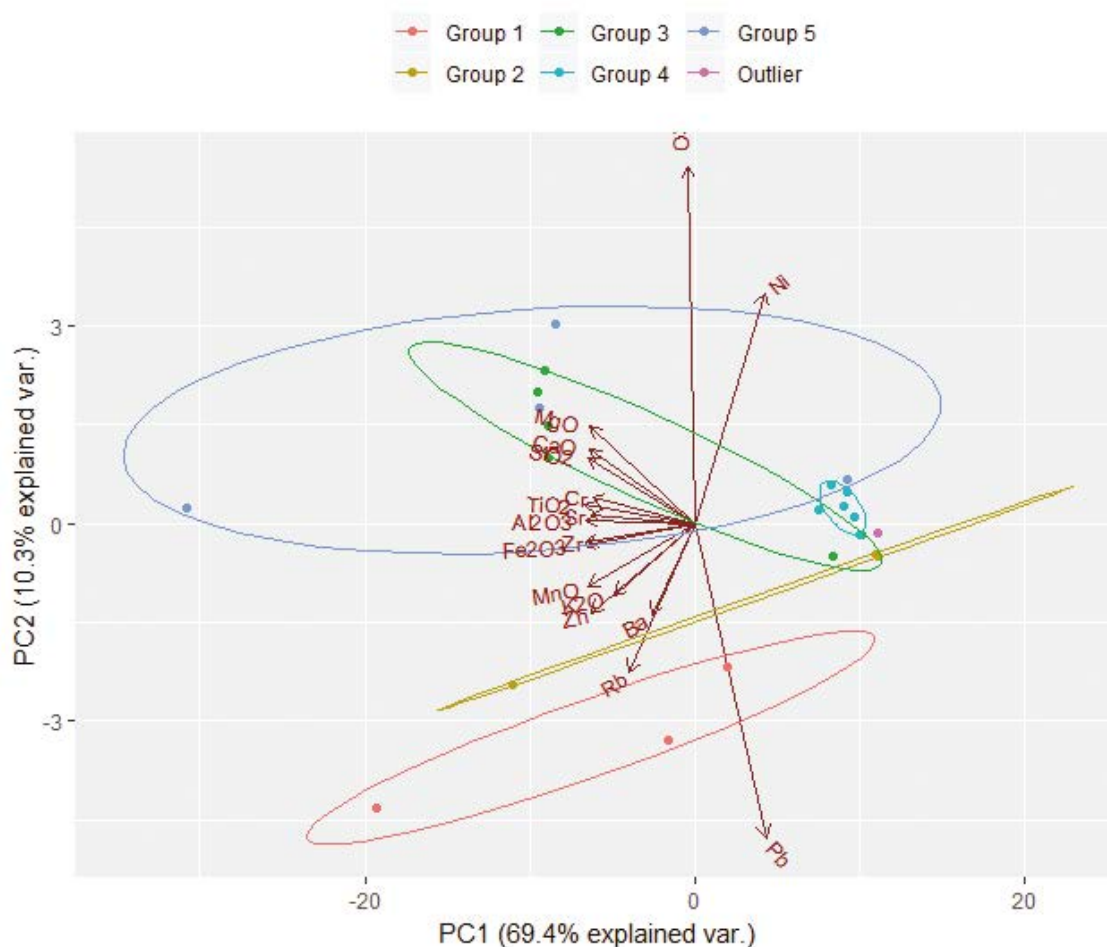


Figure 4.3-10: Biplot of principle component 1 and 2 calculated for main groups of objects as identified in the multivariate analysis of WD-XRF data for objects from S. Anna.. The ellipse indicates a 68% fit for each group.

the HH-XRF data and will evaluate the reliability of the data according to the statistical methods described in chapter 3.

4.3.3.1 CERTIFIED REFERENCE MATERIAL REGRESSION CALIBRATION

Six CRM samples were measured with the Bruker Tracer HH-XRF at the same settings as those used for measuring roof terracotta objects housed in the Archaeology museum of Agrigento and material from the S. Anna excavation. The Ti-Al (or yellow) filter was used for measuring the minor, or trace, elements at 300 seconds per reading at 40 kV. In order to measure major elements a vacuum is required. But in order to eliminate surface deposits readings are taken on clean fractures, which by nature are irregular surfaces that create a large

airgap between the object and the instrument. This airgap prevents an effective vacuum and therefore the low-Z elements were not measured. The elements used for analysis are the based on the ones already identified for the analysis of the WD-XRF data, the exceptions are elements identified by Hunt and Speakman as problematic elements for HH-XRF analysis (Na, P, V, Cr, Co, Ni, Ba, Ce).¹⁷ For the regression calibration it was not possible to calculate MgO, Al₂O₃ and La as the data for these elements were not available.

The six soil and ceramic CRMs used for the calibration are BCR-667, BIR-1a, GSP-2, NIST-98b, NIST-2710a and SGR-1b. The regression equation is calculated by comparing the certified values and the measured values for each element.

¹⁷ Hunt & Speakman 2015, p. 638.

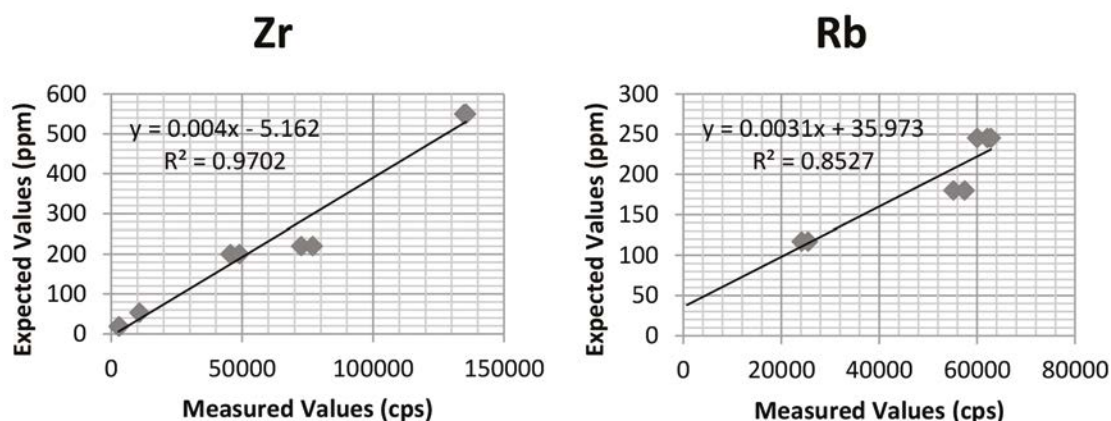


Figure 4.3-11: Biplots of the measured values in counts per second (cps) against the expected concentration in parts per million (ppm) for Zr and Rb.

A representative sample of these graphs are shown in figure 4.3-11 for the elements Zr and Rb. The regression equations and regression coefficients are provided below in table 4.3-9. The majority of elements have a regression coefficient of higher than 0.9 while Rb, and Y are above 0.8.

Based on these regression equations it is therefore possible to provide an initial empirical calibration for the HH-XRF data in order to obtain semi-quantitative values. It is possible to determine the accuracy of the quantitative values obtained through the regression calibrations by comparing the calibrated HH-XRF values of the control group with the WD-XRF results of the same. The control group is a collection of roof tile samples that were analysed using petrographic analysis, WD-XRF and HH-XRF. The HH-XRF data was calibrated using the regression equations in table 4.3-9, the same data was also calibrated using the GL2 mudrock calibration provided by Brucker. The GL2 calibration is the calibration supplied by the manufacturer for archaeological ceramics.¹⁸ The quantitative values obtained through the regression equations and the GL2 calibration are compared to the quantitative values obtained through WD-XRF (table 4.3-1 and table 4.3-2) these are shown below in table 4.3-10. The average concentration of major and minor elements for each petrographic group is shown according to the method used for

obtaining the data. The relative standard deviation is also provided in order to show the variance of each group.

Table 4.3-9: Regression Equations based on the expected and measured values for CRM samples

Element	Regression Equation	Regression Coefficient
Ca	$y = 1.2927x - 1553.7$	$R^2 = 0.9968$
Fe	$y = 0.0516x - 850.3$	$R^2 = 0.9694$
K	$y = 2.3137x - 406.97$	$R^2 = 0.9907$
Mn	$y = 0.0716x - 56.593$	$R^2 = 0.9963$
Nb	$y = 0.0041x - 1.6372$	$R^2 = 0.9869$
Rb	$y = 0.0031x + 35.973$	$R^2 = 0.8527$
Si	$y = 79.311x + 88198$	$R^2 = 0.9069$
Sr	$y = 0.0027x + 68.251$	$R^2 = 0.9645$
Th	$y = 0.0099x - 19.282$	$R^2 = 0.9919$
Ti	$y = 0.3034x + 572.33$	$R^2 = 0.9789$
Y	$y = 0.01x - 4.3155$	$R^2 = 0.8391$
Zn	$y = 0.0146x - 9.772$	$R^2 = 0.9994$
Zr	$y = 0.004x - 5.162$	$R^2 = 0.9702$

The elements which have been proven to characterize the material from S. Anna has been identified in the preceding sections, these are CaO, Fe₂O₃, MnO, SiO₂, TiO₂, Sr, Zr and Y. When the results of the calibration in table 4.3-10 is evaluated, especially regarding these elements it is found that for the majority of these elements the CRM calibrated files outperform the GL2 calibration by having less variance and being more accurate,

¹⁸ Hunt & Speakman 2015, pp. 634-5.

Table 4.3-10: Measuring the accuracy of calibrated HH-XRF data for the petrographic groups 162 against the WD-XRF data. The average concentrations of major and minor elements are for each petrographic groups is show according to the method used for obtaining the data; WD-XRF results, GL2 calibrated HH-XRF and CRM calibrated HH-XRF results.

		Group A		Group A2		Group B	
		wt%	RSD%	wt%	RSD%	wt%	RSD%
SiO ₂	WD-XRF	58.47	3.53	55.01	1.84	55.00	1.28
	CRM	61.77	5.23	53.99	8.45	58.28	3.98
K ₂ O	WD-XRF	1.33	23.61	1.42	10.62	0.91	44.05
	CRM	1.62	22.40	1.63	17.94	1.24	49.82
CaO	WD-XRF	11.63	21.96	15.83	6.72	17.26	7.67
	GL2	5.17	151.46	10.80	19.82	10.78	158.91
	CRM	14.57	16.32	17.08	8.01	21.94	12.78
TiO ₂	WD-XRF	0.92	3.79	0.92	1.19	0.86	6.91
	GL2	0.77	37.10	0.55	9.27	0.65	36.02
	CRM	0.69	5.16	0.57	6.72	0.58	6.66
MnO	WD-XRF	0.06	4.98	0.06	14.53	0.06	19.64
	GL2	0.77	83.86	0.05	15.41	0.56	83.16
	CRM	0.06	13.42	0.04	8.79	0.04	3.53
Fe ₂ O ₃	WD-XRF	6.27	3.03	6.67	3.43	6.10	6.63
	GL2	1.95	65.63	4.39	12.17	1.75	69.44
	CRM	5.15	6.44	4.00	11.56	4.22	10.57
		Group A		Group A2		Group B	
		ppm	RSD%	ppm	RSD%	ppm	RSD%
Zn	WD-XRF	120.33	12.53	153.53	4.68	120.33	23.89
	GL2	84.70	10.65	77.24	3.32	80.01	1.75
	CRM	77.01	11.42	66.26	7.88	65.09	3.28
Rb	WD-XRF	56.50	31.01	83.84	7.53	54.68	34.64
	GL2	56.41	32.94	64.58	12.38	45.92	60.74
	CRM	81.51	15.51	86.56	9.12	73.60	25.20
Sr	WD-XRF	670.14	19.61	847.53	3.22	989.44	5.39
	GL2	530.67	18.26	537.86	7.89	791.21	14.70
	CRM	444.64	14.39	431.34	4.68	536.71	10.33
Y	WD-XRF	35.98	14.41	46.56	15.75	38.10	0.00
	GL2	25.17	7.51	22.76	12.51	25.10	8.47
	CRM	44.36	11.94	34.70	6.96	34.33	11.52
Zr	WD-XRF	594.35	11.32	661.89	3.53	648.38	18.04
	GL2	246.00	9.13	220.25	3.76	232.27	10.74
	CRM	242.16	12.67	202.19	5.38	203.82	13.64
Nb	WD-XRF	50.07	78.25	38.15	21.65	38.15	21.65
	GL2	6.55	21.46	7.27	8.69	6.12	33.55
	CRM	17.97	7.42	14.93	9.04	15.47	5.16

Table 4.3-11: Chemical composition of architectural terracotta from Akragas, as measured by HH-163 XRF and calibrated using regression equations based on certified reference material.

VIN	SiO ₂	K ₂ O	CaO	TiO ₂	MnO	Fe ₂ O ₃	Zn	Rb	Y
136	44.18	1.69	8.75	0.55	0.09	3.97	110.17	73.52	18.96
137	47.14	1.39	10.79	0.65	0.13	4.65	92.84	79.04	39.35
138	44.01	1.73	3.32	0.66	0.09	4.46	78.06	83.68	22.82
139	38.49	1.83	7.11	0.57	0.10	4.31	100.58	84.75	25.36
145	38.58	0.85	5.91	0.47	0.03	2.79	111.42	70.92	19.69
146	48.34	2.21	15.87	0.59	0.06	4.50	125.07	91.95	34.48
147	42.69	1.07	12.81	0.54	0.05	4.04	117.48	67.18	31.99
148	44.45	0.97	7.11	0.69	0.06	4.60	143.48	80.07	28.75
166	44.34	2.08	2.73	0.79	0.11	5.43	101.99	97.88	23.80
167	46.68	1.79	6.71	0.72	0.10	5.36	92.31	74.58	23.62
168	45.88	2.56	2.89	0.82	0.13	5.97	115.90	99.57	26.63
169	44.15	1.57	8.02	0.61	0.10	4.67	117.34	73.59	33.54
177	36.75	1.24	31.06	0.33	0.02	2.08	81.04	67.14	18.81
178	45.52	1.55	16.08	0.50	0.04	3.77	272.43	78.23	32.45
179	36.72	1.19	8.04	0.58	0.09	4.58	106.55	65.20	32.50
181	39.01	0.97	19.17	0.44	0.06	3.26	74.05	71.06	25.62
183	43.06	1.53	14.15	0.63	0.13	5.10	89.00	73.98	33.70
184	55.55	2.32	12.02	0.77	0.11	6.46	102.12	79.74	41.60
253	55.16	1.59	9.68	0.64	0.04	4.47	69.64	82.80	38.76
255	61.13	1.85	9.12	0.59	0.05	4.13	121.19	84.77	33.61
256	56.47	1.48	9.36	0.77	0.06	5.38	148.13	83.72	51.90
257	36.73	1.05	51.12	0.28	0.04	3.65	240.52	67.60	17.36
258	46.51	1.40	11.55	0.74	0.12	5.34	275.82	88.21	39.32
259	51.60	1.98	16.06	0.52	0.05	3.93	85.19	89.25	40.54
260	48.26	1.95	17.32	0.56	0.04	4.25	290.86	81.48	22.67
261	44.29	1.64	46.65	0.37	0.05	3.58	110.53	74.75	39.43
262	36.58	1.61	65.13	0.22	0.03	2.86	86.22	86.26	31.63
266	36.66	0.94	24.18	0.33	0.03	2.48	61.72	70.68	21.60
421	49.88	1.29	15.54	0.53	0.04	3.49	60.76	77.52	31.92
422	64.50	2.06	16.51	0.68	0.06	5.06	84.21	96.11	45.19
423	53.20	1.81	18.16	0.57	0.05	4.11	71.16	90.07	36.24
424	58.69	0.57	22.07	0.62	0.05	4.74	66.80	53.80	38.52
425	62.11	1.06	17.91	0.66	0.07	4.96	67.46	67.06	43.13
426	55.78	1.38	19.07	0.55	0.04	3.94	62.70	76.43	30.66
427	58.90	1.79	17.54	0.61	0.05	4.40	66.87	92.09	35.94
428	64.59	2.05	13.53	0.70	0.06	5.13	83.65	102.09	46.77
429	63.10	1.05	19.80	0.73	0.06	5.51	77.47	57.00	42.69
430	61.20	1.75	13.77	0.75	0.06	5.63	64.55	70.88	39.06
431	60.57	1.44	18.95	0.56	0.04	4.06	67.88	81.01	34.40
432	60.97	1.34	15.06	0.68	0.06	5.01	81.97	73.60	46.98
433	60.36	1.78	24.67	0.57	0.05	3.99	65.78	90.58	33.81
434	57.12	0.98	20.07	0.63	0.05	4.60	71.17	62.64	32.76
436	56.33	1.86	11.81	0.66	0.05	4.76	79.17	94.75	38.88
437	65.53	1.65	12.37	0.72	0.07	5.47	84.69	86.65	52.91

Table 4.3-12: Summary of Principle component analysis performed on all the HH-XRF data for objects from Akragas. The first 6 components are shown, which collectively account for 98% of the variance in the data.

	PC1	PC2	PC3	PC4	PC5	PC6
Standard deviation	1.777	1.586	1.303	0.825	0.665	0.560
Proportion of Variance	0.351	0.279	0.189	0.076	0.049	0.035
Cumulative Proportion	0.351	0.630	0.819	0.894	0.943	0.978

Table 4.3-13: The loading of each major and minor element within each principle component.

	PC1	PC2	PC3	PC4	PC5	PC6
SiO ₂	-0.109	0.500	0.290	-0.429	0.298	-0.145
K ₂ O	-0.020	-0.318	0.570	0.306	-0.063	-0.637
CaO	0.486	0.253	-0.123	0.131	0.328	0.043
TiO ₂	-0.521	0.082	0.081	-0.322	-0.026	0.029
MnO	-0.415	-0.273	-0.216	0.422	0.181	0.324
Fe ₂ O ₃	-0.523	0.051	-0.118	-0.041	0.104	-0.158
Zn	0.153	-0.425	-0.327	-0.559	-0.395	-0.159
Rb	0.073	-0.235	0.633	-0.180	-0.094	0.640
Y	-0.072	0.515	0.035	0.278	-0.769	0.071

as measured against the WD-XRF values. The performance of the CRM calibrated files on the trace elements, however, does not perform as well in some cases. The calibrated values for Sr and Zr are significantly lower than the WD-XRF results. The reason for this difference for these elements is not known and is also not seen in the study by Hunt.¹⁹ One possibility might be attributed to the coarse fabric of the terracotta objects. The WD-XRF samples as well as the samples measured by Hunt were ground down to a fine powder. The effect of larger grain sizes on the measurements obtained with XRF is well known and is referred to as the matrix effect.²⁰ The large discrepancies in the Sr and Zr measurements might therefore potentially be attributed to the matrix effect. The variance in the different groups, as indicated by the relative standard deviation (RSD%) is roughly the same for both the WD-XRF and CRM calibrated HH-XRF data.

¹⁹ Hunt & Speakman 2015

²⁰ Hunt & Speakman 2015, p. 632.

The CRM calibrated files thus outperform the manufacturer calibration (GL2) both in terms of correspondence with known quantitative results obtained through WD-XRF analysis as well as showing less variance. For the elements of Sr, Zr and Nb the calibrations are not reliable however, and will therefore not be incorporated in further statistical analysis.

A number of objects from Akragas were measured with the HH-XRF using the same settings as those used for measuring the CRM samples for the regression analysis. The regression calibration developed above can therefore be applied to these objects. The calibrated HH-XRF data for architectural terracotta from Akragas is provided in table 4.3-11. As already mentioned, a collection of objects from S. Anna were analysed using petrographic analysis, WD-XRF as well as HH-XRF. The calibrated HH-XRF data for this group of objects is included in table 4.3-11 as a control.

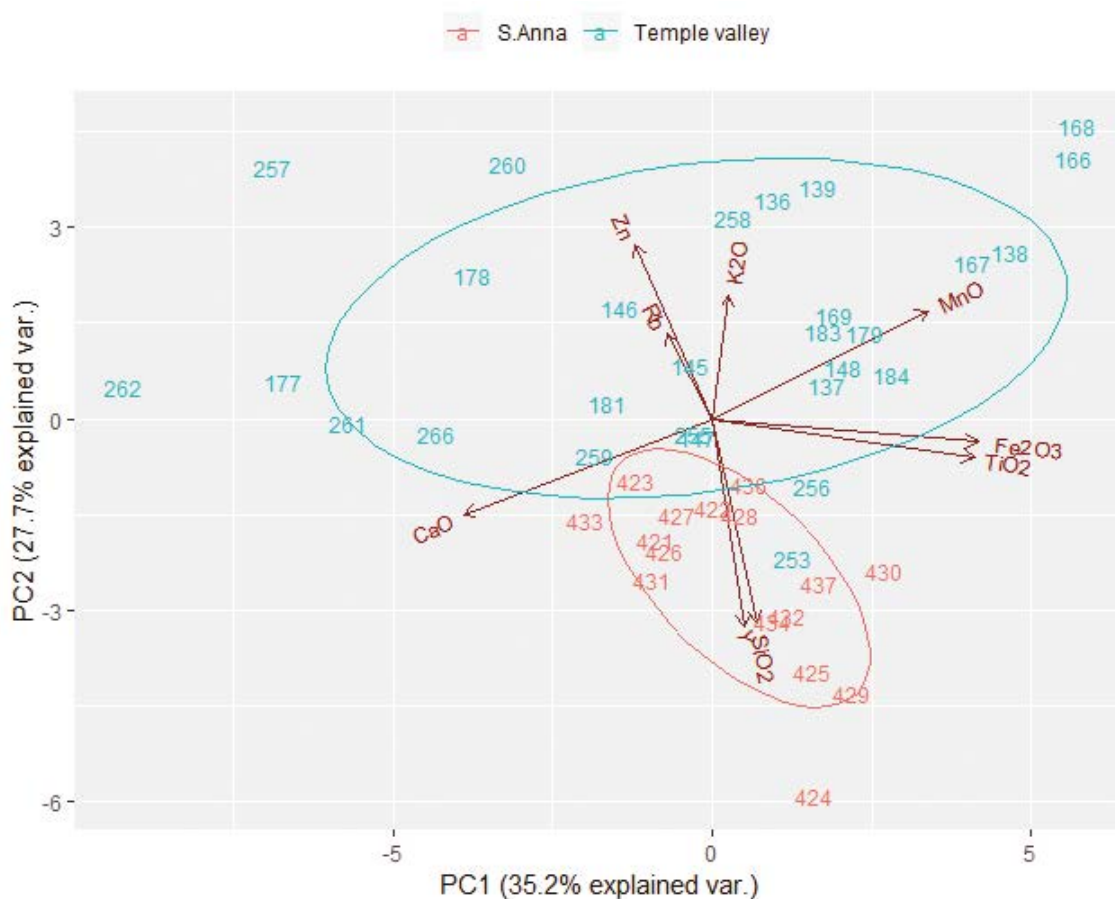


Figure 4.3-12: Biplot of the HH-XRF data for a collection of fragments from the urban area of Akragas (Valley of the temples) as well as a collection of roof tiles from S. Anna. The ellipse indicates the 68% confidence interval for each group.

4.3.3.2 PRINCIPLE COMPONENT ANALYSIS OF HH-XRF DATA

The calibrated HH-XRF data as shown in table 4.3-11 is analysed using the same statistical methods used in preceding sections. The summary data for the principle component analysis is provided below in table 4.3-12 and the loading on each element is shown in table 4.3-13. Principle component 1 and 2 collectively account for 63% per the variance in the dataset. The elements involved with these two components show a correlation between TiO₂ and Fe₂O₃, which are negatively correlated with CaO. SiO₂ shows a correlation with Y.

The first two principles are plotted on a biplot in figure 4.3-12. The objects measured with the HH-XRF can be divided into two groups. The first groups of objects are architectural terracotta fragments housed in the archaeological museum and which are associated with the sanctuaries

inside the city of Akragas, or what is known as the valley of the temples. The control group consisting of roof tile samples from the extra urban sanctuary of S. Anna. The two groups plot as two distinct entities. The objects from the valley of the temple can be distinguished from the objects from S. Anna due to a higher concentration of Zn and a lower concentration of SiO₂ and Y. Two objects from the urban area (VIN 136, 138) overlap with the S. Anna group. The objects from S. Anna also has a lower concentration of CaO. While the objects from the urban area are grouped together, there are at least 4 objects (VIN 262, 177, 261, 266) which appears distinct from the main groups due to higher concentrations of CaO, while VIN 168 and 166 have lower levels of CaO but higher levels of MnO.

All the groups show higher variance, which objects with a standard deviation of more than 1

Table 4.3-14: Published data obtained through wavelength dispersive X-Ray Fluorescence (WD-XRF) used for comparison with the WD-XRF data from the S. Anna excavation in Agrigento

Location:	Period	Material	Instrument	Publication
Gela	Archaic Hellenistic	and Fine grain pottery	Philips PW2404/00	Aquila et al 2012 table 1
Syracuse	Archaic Hellenistic	and Fine grain pottery	Philips PW 2400	Barone, et al., 2005, table 2
Lentini	Archaic Hellenistic	and Fine grain pottery	Philips PW 2400	Barone, et al., 2005, table 2
Messina	Archaic Hellenistic	and Fine grain pottery	Philips PW 2400	Barone, et al., 2005, table 2
Naxos, Francavilla and Toarmina (Alcantara Valley)	Archaic and Roman	Amphora, bricks and roof tiles	Philips PW2404/00	Belfiore, et al., 2010, table 5&6
Akragas (valley of the temples)	VI-Vth century	Amphora and roof tiles	Philips PW 2400	Barone, et al., 2003, table 4
S. Anna	Archaic Classical	and Roof terracottas	Panalytical Max	Axios New data

(the 68% confidence interval shown as an ellipse on the biplot). In the case of the S. Anna group, the petrographic and WD-XRF analysis have already shown the presence of at least 3 subgroups. Due to the high variance in the group of objects from the urban area in Akragas, subgroups are therefore a likely prospect. These subgroups are likely linked to stylistic groups and will be explored in chapter 5.

4.3.4 PROVENANCE

The large number of archeometric studies published on ceramic and terracotta objects from Sicily provides the opportunity to compare the S. Anna objects to objects from other sites in Sicily. While it is possible to compare quantitative data obtained through different methods, a recent study by Hein et al recommend the use of correction factors in order to compensate for discrepancies that arise due to different analytical set ups.²¹ For this reason, only data obtained by using the same analytical method is used in order to avoid the necessity of correction factors. The published data

used for comparison is detailed in table 4.3-14. Only objects for which the provenance has clearly been established by the relevant scholars are included in this analysis. The collection of published reference material consists of ceramics and terracotta objects from the Greek and Hellenistic periods.

The chemical composition of both the published reference groups as well as the objects from S. Anna can once again be analysed using principle component analysis in order determine the chemical characteristics of each group as well as potential overlap. The summary from this analysis is provided in table 4.3-15 and table 4.3-16. Principle component 1 and 2 are collectively responsible for 51% of the variance in the dataset. Component 1 is characterized by a high loading on K_2O and Ce (>0.20) and a high negative loading on Sr, Cr, Zr and Ba (< -0.30). Component 2 has a high loading on CaO and Ce (>0.20) and the highest negative loading is on Al_2O_3 , Fe_2O_3 , MnO and Ni (< -0.40).

The relationship between component 1 and 2 is visualized in figure 4.3-13. There is overlap between objects from Gela and those from Messina and the

²¹ Hein, et al. 2002.

Table 4.3-15: Summary of Principle component analysis performed on published WD-XRF data 167 for objects from Sicily as well as objects from the S. Anna excavation. The first 12 components are shown, which collectively account for 97% of the variance in the data.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12
Standard deviation	2.53	1.79	1.68	1.23	1.09	0.92	0.87	0.69	0.63	0.54	0.52	0.51
Proportion of variance	0.34	0.17	0.15	0.08	0.06	0.04	0.04	0.03	0.02	0.02	0.01	0.01
Cumulative proportion	0.34	0.51	0.65	0.74	0.80	0.84	0.88	0.91	0.93	0.94	0.96	0.97

Table 4.3-16: The loading of each major and minor element within each principle component.

	PC1	PC2	PC3	PC4	PC5	PC6	PC7	PC8	PC9	PC10	PC11	PC12
SiO ₂	0.13	0.15	-0.44	0.02	-0.32	0.03	-0.21	0.38	-0.05	0.23	-0.01	0.01
TiO ₂	-0.04	-0.15	-0.37	0.49	-0.15	-0.27	0.16	-0.27	0.04	0.07	0.00	0.16
Al ₂ O ₃	-0.01	-0.36	0.32	0.20	0.16	0.13	-0.37	-0.18	0.04	0.19	0.02	0.14
Fe ₂ O ₃	0.13	-0.41	-0.19	0.35	-0.04	-0.15	0.03	-0.15	0.10	-0.02	-0.03	-0.07
MnO	0.18	-0.33	0.05	-0.24	-0.30	0.17	0.31	-0.14	0.18	-0.56	0.01	-0.18
MgO	-0.07	-0.24	-0.02	-0.40	0.35	-0.54	0.29	0.16	0.34	0.24	-0.05	0.09
CaO	-0.24	0.33	0.15	0.01	0.30	0.01	0.11	-0.33	-0.19	-0.05	0.00	0.07
Na ₂ O	0.19	-0.09	0.19	-0.33	-0.46	-0.05	0.20	-0.31	-0.30	0.55	0.16	0.07
K ₂ O	0.28	-0.26	0.23	0.03	0.15	0.14	-0.18	0.05	-0.10	0.03	0.00	0.10
Sr	-0.35	0.08	-0.02	0.05	-0.10	0.08	0.26	-0.29	-0.03	0.02	0.10	-0.19
Cr	-0.37	-0.08	-0.09	0.00	0.03	-0.10	-0.09	-0.04	0.03	0.05	0.15	-0.09
Ni	-0.18	-0.36	-0.09	-0.02	0.12	-0.19	0.05	0.20	-0.80	-0.16	-0.06	-0.15
Zn	-0.29	-0.20	0.20	0.22	-0.08	0.16	0.02	0.09	0.18	0.18	0.27	-0.04
Rb	-0.04	0.02	0.42	0.34	-0.12	0.02	0.40	0.53	0.02	0.13	-0.01	-0.21
Y	-0.05	0.14	0.35	0.04	-0.32	-0.55	-0.39	-0.12	0.06	-0.10	-0.32	-0.37
Zr	-0.37	0.02	-0.10	-0.04	-0.13	0.15	0.01	0.03	0.07	0.09	0.03	-0.16
Nb	-0.29	-0.05	0.15	-0.10	-0.32	-0.21	-0.17	0.18	0.00	-0.33	0.37	0.59
Ba	-0.31	-0.15	0.02	-0.07	-0.17	0.25	0.07	0.02	0.03	0.07	-0.79	0.36
Ce	0.23	0.28	0.17	0.31	-0.01	-0.20	0.32	-0.03	-0.12	-0.11	-0.08	0.37

Alcantara Valey, which incorporates objects from Naxos, Taormina and Francavilla. The objects from S. Anna is clearly identifiable as a separate group due to much higher concentrations of CaO, Sr, Cr and Zr and low concentrations of SiO₂, Ce, and K₂O.

The published data for amphora and roof tiles from the valley of the temples at Akragas as indicated in table 4.3-14 only provide information for 11 elements. The large number of unavailable data can skew the statistical analysis, so this group of objects were omitted from the principle component analysis above. However, if the analysis is repeated, this time using only the 11 elements for all the

available published data the following biplot for principle component 1 and 2 is created (figure 4.3-14). This plot still shows a separation between the objects from S. Anna and the published data. But there is an overlap between some of the objects from the valley of the temples. This group of objects consists of roof tiles and amphora. It is possible that the amphora came from a different raw clay source than the roof tiles, which would explain why some of the objects are not grouped together. Once again, the roof tiles from S. Anna is characterized by high concentrations of Cr and CaO.

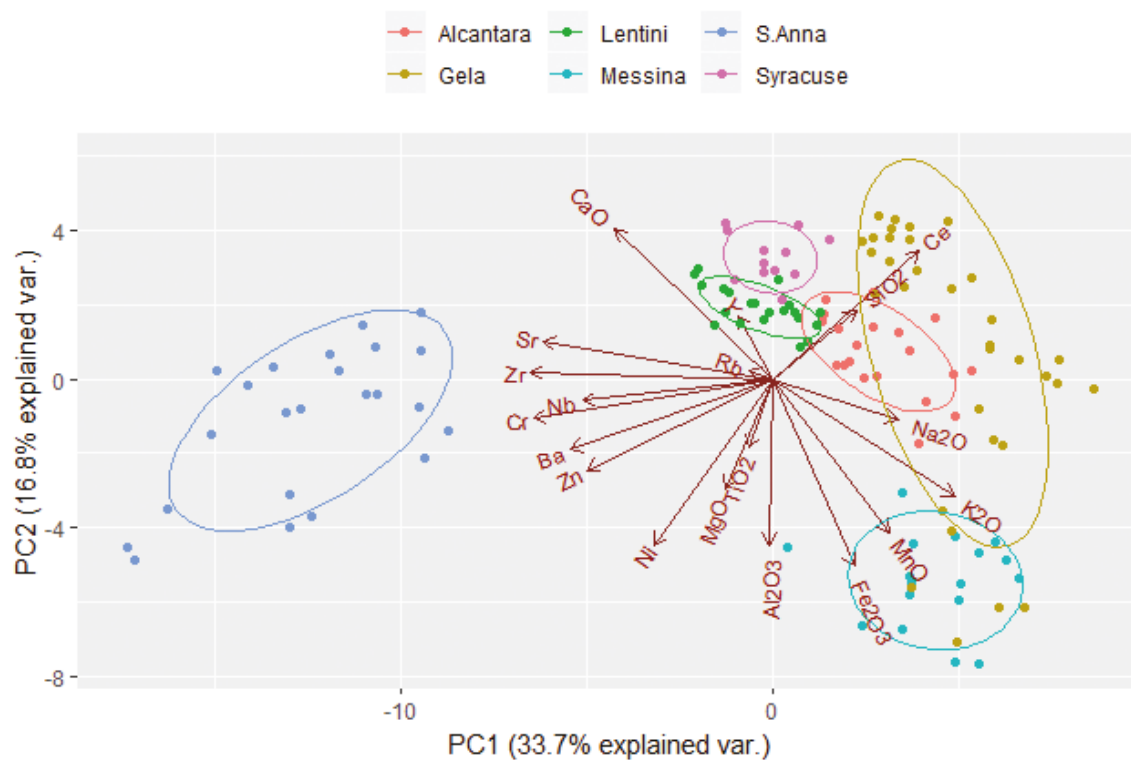


Figure 4.3-13: Biplot of the first two principle components based on the published WD-XRF data for locations in Sicily as well as the S. Anna objects. The ellipse indicates the 68% confidence interval for each group.

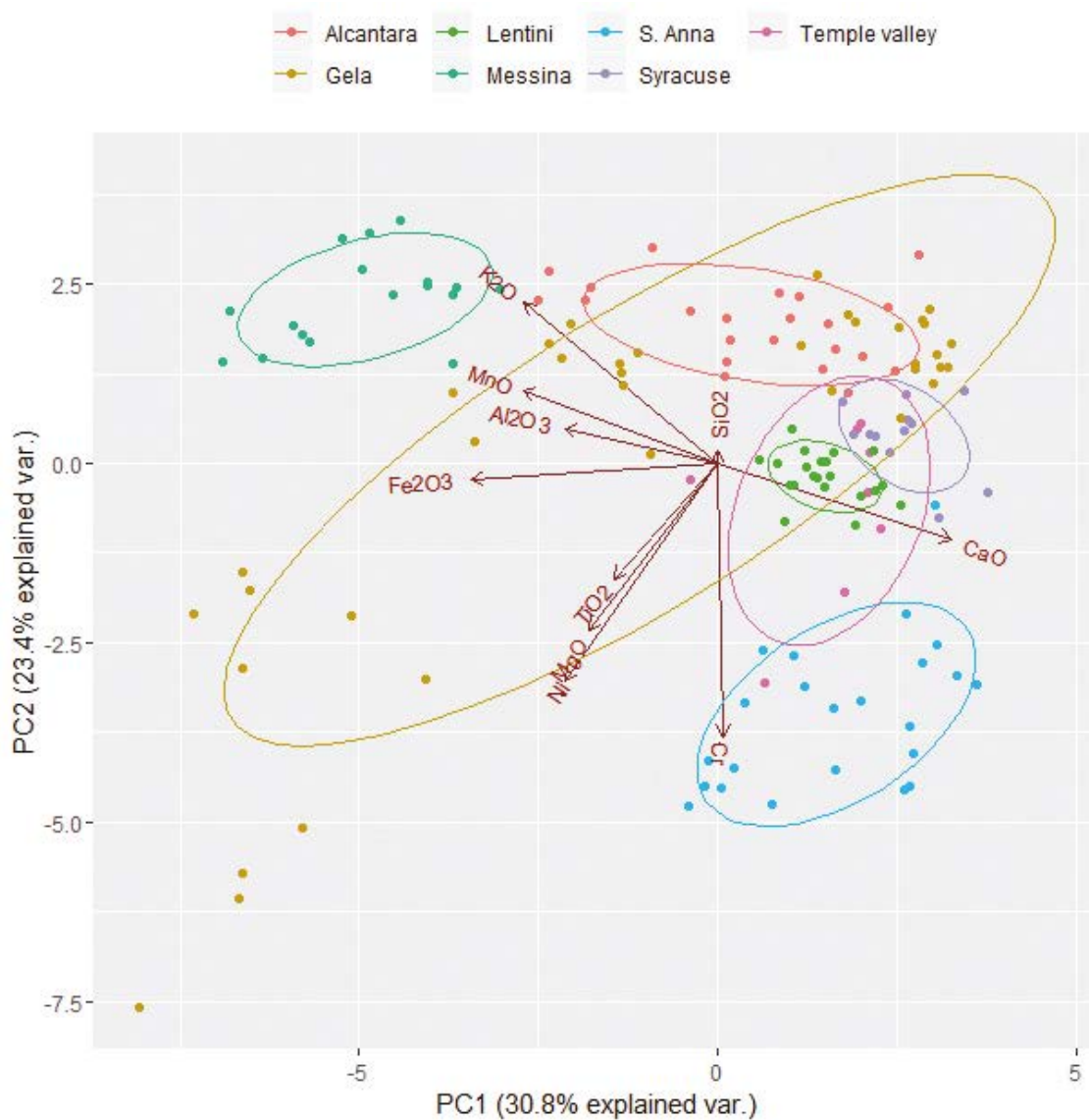


Figure 4.3-14: Biplot of the first two principle components based on the published WD-XRF data for locations in Sicily as well as the S. Anna objects. This dataset includes published data for Akragas, but only uses 11 elements for analysis. The ellipse indicates the 68% confidence interval for each group.

4.4 ARCHITECTURAL CONTEXT

Architectural terracottas are complex manufactured objects whose shape is influenced by various material and ideological factors. One of the main material factors identified in section 2.3 is architectural function by which the objects are intended to form part of a roof. In this regard objects are expected to address requirements such as structural stability, waterproofing and protection of underlying structures. Thus, it is one of the research aims of this investigation to explore in more detail the technical solutions employed by craftsmen to fulfil the functional demands. The history of research in section 2.1 demonstrates the scarcity of archaeological studies which address questions relating to actual architectural function. Where research examples exist, these mostly consists of older and partly outdated publications.¹ Therefore, the study of the architectural function of terracotta roof elements from Akragas must start with a systematic reevaluation of the preparation of the objects themselves as well as the way in which the different roof elements connect in order to become a roof.

4.4.1 FROM THE WORKSHOP TO THE BUILDING SITE

A modern, industrialized, perception of objects produced from a mould presume identical and interchangeable objects. But this modern perception is not applicable to the past. As the objects from Akragas can attest, architectural terracottas produced by a manual process involving moulds and forms are not identical, nor consistent. And irregularities in the painted decoration have already been described in section 4.2.1.7. The production process affects then not only the painted decoration, but the shape of the profile as well. Examples of inconsistencies in the form include changes in dimensions and objects also being twisted out of the desired plane. This can be

attributed to the mechanics of manual production including the handling of objects when not yet completely dry, changes in drying conditions and inconsistent firing. Various fragments from Akragas show these inconsistencies (e.g. frieze A, section 4.1.1). The curvature of the cavetto fragment (VIN 286) is different from the left to the right side of the object, resulting in a slightly twisted form. There is also considerable variation in the dimensions of specific profile elements: for example, the height of the uppermost fascia on the sima varies with a couple of millimetres from object to object; with 43 mm for VIN 286, 41 mm for VIN 355, and 46 mm for VIN 283.

In the absence of complete revetment pieces there is not enough evidence to determine overall dimension variations but based on the inconsistencies already discussed it seems probable that they could have varied to such a degree that it would be easily visible. The plain roof tiles from Gordion were found to vary up to 10 mm, while the ones from Selinus differ in 10-20 mm.² Whereas this might not be considered a major problem for plain roof tiles due to a more robust overlapping connection system, on the sima and geison revetment a step or gap of 10 mm between two elements would be visually jarring. To ensure the best fit and to correct any discrepancies, De Miro suggests that objects were placed in sequence after firing but before the application of painted decoration. During this process, objects could be reshaped as needed. He sees the chisel marks on the base of VIN 276 (figure 4.4 1) as evidence of this procedure. From the traces left in the clay it appears that the chisel was not applied to wet clay, and the painted decoration is applied on top of these marks.³ But there are a couple of concerns regarding this theory. Firstly, according to conventional knowledge, the paint was added

¹ Gabrici, 1956; Kunze & Schleif 1944, Orsi 1918.

² Conti 1998, pp. 216-226; Henrickson & Blackman 1999, p. 310.

³ De Miro 1965, pp. 41-42.

before firing.⁴ And, secondly, reshaping terracotta objects after firing is a difficult and risky task, as the terracotta is both hard and brittle, which makes it liable to crack under sharp impact. It seems therefore more probable that slight alterations were made with a chisel when the piece was bone-dry, but before firing. Confirming this procedure, additional chisel marks can be seen on VIN 353 and VIN 276. Their preparation indicates that the fit between individual elements was thus tested, and adjusted, before firing. However, the production process concerning the painted decoration is less clear. The meander pattern on the top fascia of frieze A (figure 4.1-1) is clearly interrupted by the edge of a tile. A more sensible interruption would be between two meanders, on a symmetry line. It is possible that while the objects were placed in sequence they were then also painted allowing, for example, the meander to be drawn across adjoining tiles. At the moment, however, there is not enough evidence to explore this hypothesis further.

After fitting and painting objects, the terracottas were placed in the kiln for firing and then eventually transported to the work site before being placed on the building. Due to the individual fit of the tiles, the order in which they are positioned is crucial. It is thought that this individual sequence was indicated by different marks on the back side of the objects.⁵ There are a number of such marking systems known for canonical Sicilian simas including the roofs associated with the Athenaion and Olympieion at Syracuse and frieze B from Gela. On the Athenaion roof, this sequence consists of vertical lines and circles which do not correspond with known Greek numbering systems. On the Olympieion roof, there are painted figurative elements.⁶ A similar system is found on the back of the anthemion sima formerly associated with

temple Y at Selinus.⁷ At Gela, a large amount of vertical lines and dots were painted on the back side of sima and geison revetment fragments from frieze B, and there are also evidence of more complex symbols, such as the vertical lines and crosses on the frieze C.⁸

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Figure 4.4-1: Chisel marks visible on top corner of the horizontal flange of geison revetment associated with frieze A (VIN 276. Copyright Regione Siciliana – Assessorato Reg.le dei BB. CC. e I. S. – Su concessione del Polo Regionale di Agrigento – Museo Archeologico “Pietro Griffo” – divieto di duplicazione con qualsiasi mezzo).

A number of inscribed or painted traces on the reverse side of objects from Akragas can be interpreted as marks that are supposed to help builders place objects in the correct location or sequence: for example, the painted arrow at the top of VIN 276 from roof 1 (figure 4.4 1) or the three inscribed vertical lines on the back of VIN 355. On one side of an eaves tile (VIN 383, figure 4.1-36) there is part of a painted figurative element as well as the Alpha letter preserved. Nevertheless,

4 Winter, 1993 p. 306.

5 Brea 1949, p. 47; Ciurcina 1997, p. 36; Winter 1993, p. 307.

6 Ciurcina 1997, p. 36.

7 Conti 2012, pp. 197-198, fig 181-3.

8 Brea 1949, pp. 47, 56, fig 35, 43.

the exact interpretation of these marks remains difficult. As seen with the well-preserved example from Syracuse, the marks do not correspond with common Greek numbering systems. It is therefore likely that a workshop used its own numbering system. At this moment, the fragmentary nature of the remaining tiles and painted traces does not permit a detailed reconstruction of individual marking systems in Akragas.

4.4.2 THE CONNECTIONS BETWEEN TERRACOTTA ROOF ELEMENTS

An integral step in looking at roofs as an architectural and functional entity is the investigation of the way individual elements connect with each other. The manner in which a specific roof element is placed in relation to an adjacent component is a fundamental part of a roof's design as it has an impact on the stability, waterproofing and visual effect of the roof. While some connections are quite well documented and understood, others have not yet received comprehensive scholarly attention. The following overview presents thus the different types of interconnections of terracotta roof elements in greater detail.

4.4.2.1 PAN AND COVER TILES

The manner in which the plain roof tiles connect with each other is quite well understood. While Winter does not visually show the typical Sicilian roof, she does detail the way in which different roof elements connect for a number of different types of Greek roofs, including the Corinthian roof of the Megarian treasury at Olympia.⁹ The roof tiles from Selinus and the manner in which they interconnect is well documented thanks to the work by Conti¹⁰ and Jonasch.¹¹ In contrast, very little information is available regarding the plain roof tiles of the archaic period of Akragas, as described above in section 2.1. The roof tiles from the recent S. Anna

excavation are dated to the 5th and 4th century based on the profile types as identified by Conti (section 4.1.59-64). And they all come from a secondary context. A single pan tile fragment from Gàbrici's excavations to the south of temple B at Akragas (section 4.1.65) has a similar profile to material from S. Anna. No example from the 6th century has been identified. Due to the fragmentary nature of the available information for this small collection of roof tiles it is not yet possible to determine which pan tiles and cover tiles were used on the same roof.

All the pan tiles detailed in chapter 4.1 have a rounded edge on the long sides of the flat rectangular tile. At the bottom, there are two notches on the underside or the corners to allow for the overlap between tiles (figures 4.1-64). This method of connecting pan tiles is also known from the roofs of Selinus,¹² where the examples are similar to the group of pan tile B from Akragas (section 4.1.63). To illustrate the specific connection between plain roof tiles this type of pan tile B is thus used as an example (figure 4.4 2). It is important to note that the overlap of pan tiles means that each individual pan tile is at a different angle than the main roof slope. For example, if the slope of the roof rafters are 18 degrees, then the slope of 700 mm long pan tiles is 15 degrees. The difference is caused by the raising of the bottom of the pan tile with 30 mm (the thickness of the pan tile) in order to overlap with the lower one.

The archaeological remains from Akragas do not provide enough information on the overall dimensions of the pan tiles nor the rounded cover tiles. Therefore, the roof from Selinus represents a significant reference for the reconstruction, especially due to strong stylistic similarities between the tile profiles of the two sites.¹³ The top right pan tile in the digital reconstruction is tilted

9 Winter 1993, pp. 28-32, fig 4.

10 Conti 1998.

11 Jonasch 2009.

12 Part of a roof consisting of pan tiles that fall within Conti's type 7 is reconstructed physically by Jonasch (Jonasch 2009, p. 3, fig 3, 15-17).

13 Jonasch 2009.

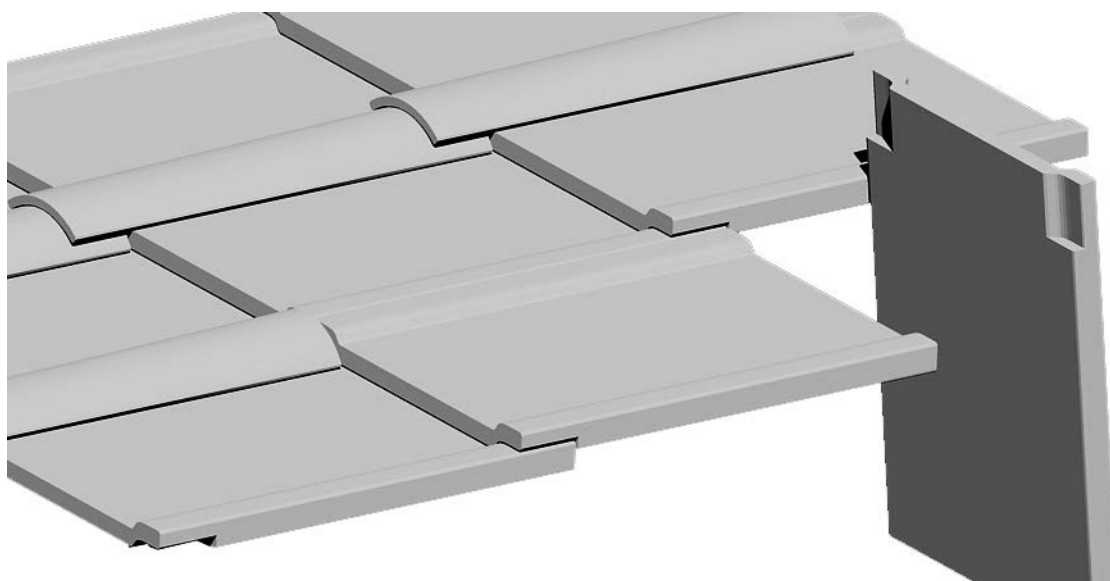


Figure 4.4-2: Digital reconstruction of system in which pan and cover tiles are connected. Pan tile profile is based on pan tile group B. The cover tiles are based on examples from Selinus.

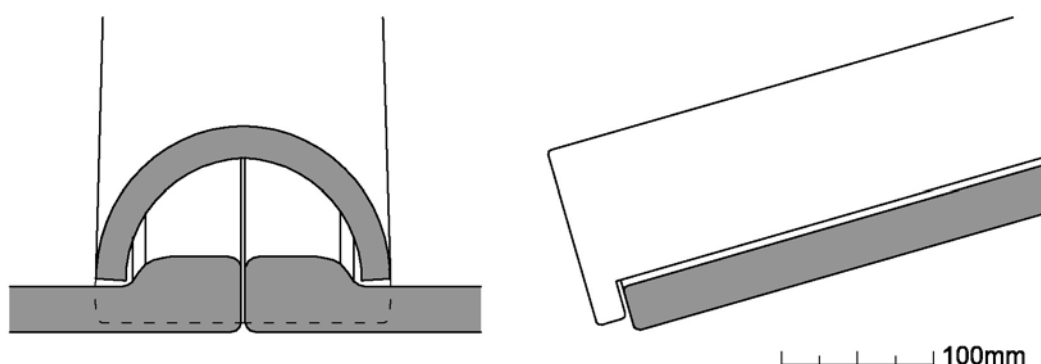


Figure 4.4-3: Antefix and pan tile connection. The front view is on the left, with the antefix plaque shown in dashed lines. On the right is a side view, cutting through the pan tile. The curved cover tile of the antefix is based on antefix B and the pan tiles are based on pan tile group B

upwards in order to show the underside of the tile itself (figure 4.4 2). The first two cover tiles on the right are also digitally removed, thereby uncovering the connection between adjoining pan tiles. While the adjacent pan tiles are connected to each other at the bottom and top by an overlap of around 100 mm, the tiles placed in a horizontal row are not overlapping. The separate cover tile overarches instead the gap between such two adjoining pan tiles and also overlaps with the other cover tiles at the top and bottom.

4.4.2.2 ANTEFIX AND EAVES TILES

The placement and connection between eaves tiles and antefixes are also quite well documented. Winter provides detailed drawings and reconstructions for various types of antefix roof systems, including the Corinthian roof.¹⁴ At Naxos, the 5th century ship sheds with the gorgon and silen antefix roof are another example.¹⁵ In both cases, the antefix profile provides the information regarding the placement and size of the cover tile. The majority of antefix fragments from Akragas is combined with a curved cover tile that is connected to the plaque along its top edge (antefix B, D, E

¹⁴ Winter 1993, fig, 4, 8-9.

¹⁵ Lentini, et al. 2008.

and H; section 4.1.23, 25, 26 and 29). On antefix C (section 4.1.24), however, the cover tile is set below the top edge by about 15 mm. The more common placement of the curved cover tile on antefix A, B, C, D, H and L also shows that it did not extend all the way to the bottom edge of the antefix plaque. This means that if the cover tile is placed on top of the eaves tile, the antefix plaque would cover part of the taenia (the visible front edge of an eaves tile). This connection between antefix and eaves tile is illustrated below using the early 5th century antefix B (section 4.1.23) and the 5th century pan tile B profile (figure 4.4-3). From the painted decoration on the underside of eaves tile A (section 4.1.35) it is clear that the eaves tile cantilever beyond the supporting roof structure.

4.4.2.3 RIDGE TILES



Figure 4.4-4: Connection between two ridge tiles (ridge tile type C)

Where the pan and cover tiles meet at the ridge of the roof, there is a gap which is protected by the central ridge tiles (figure 4.4 5). These curved tiles found at Akragas have a raised border on one edge which incorporates a notch on the inside to accommodate the end of the adjacent tile (figure 4.4-4). This type of overlap design is known for other ridge tile examples from Sicily from the archaic period including from Gela¹⁶ and Selinus.¹⁷ In contrast, the polygonal shaped ridge tiles of the early classical period from Selinus have a stepped edge, not a raised border.¹⁸

As shown in section 4.1.51-57, the overlap design of the raised border varies at Akragas. The simplest

16 Brea 1949, p. 59, fig. 58.

17 Conti 2012, pp. 264-268.

18 Conti 2012, pp. 268-271, fig. 269-70.

design is a single rounded border, as seen in ridge tile C (section 4.1.53). But more elaborate borders consisting of two or more rounded bands are also common. In terms of function, the different ridge tile types work on the same notching principle as illustrated in figure 4.4-4.

The connection between ridge tile and cover tiles are facilitated by a hole on each side of the ridge tile as seen on VIN 401 (figure 4.1.52) and VIN 571 (figure 4.1.60). This allows for part of the cover tile to extend below the overarching ridge tile, and thus providing a protected connection (figure 4.4-5). This connection method is also known for ridge tiles from other colonies including Gela¹⁹ and Selinus.²⁰

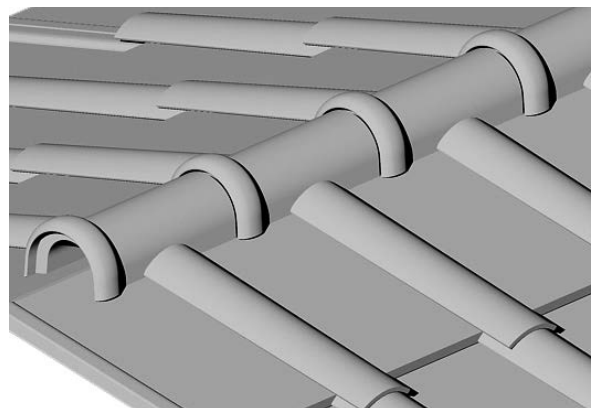


Figure 4.4-5: Graphic reconstruction of ridge tiles on a pitched roof.

4.4.2.4 SIMA AND GEISON REVETMENT

The connection between the sima and geison revetment elements must be different from the interconnections of pan, cover and ridge tiles as there is no overlap intended between two sima or two geison objects. Instead, the sima and geison revetment pieces are placed directly next to each other with the side edges abutting. For the objects from Akragas two types of side edges are present. On a number of fragments there are clear remains of a stepped edge (figure 4.4-6) while on others

19 Brea 1949, p. 67, fig. 59.

20 Conti 2012, pp. 268-271, fig. 269-70.

there is just a straight edge (figure 4.1.13). It should be noted that the stepped edge is only applied to the upstand portion of the sima. The horizontal portion appears to have a straight edge according to the preserved fragments.

The two types of side edges on sima and geison revetment pieces are detailed in table 4.4-1. For a few stylistic groups, fragments with preserved side edge are not available, these are indicated as unknown. In essence the canonical Sicilian sima roofs (frieze A and D) have a stepped edge on the sima pieces and a straight edge on the geison revetment tiles. The anthemion roof (frieze G) presents a straight edge on both the sima and geison revetment.

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Figure 4.4-6: Stepped edge on sima fragments from roof 1: showing the step on the right and left hand side of the sima (VIN 260, VIN 257. Copyright Regione Siciliana – Assessorato Reg.le dei BB. CC. e I. S. – Su concessione del Polo Regionale di Agrigento – Museo Archeologico “Pietro Griffo” – divieto di duplicazione con qualsiasi mezzo)

The use of a stepped edge is quite common for the architectural terracottas in Sicily. Examples of roofs with the stepped edge on the canonical sima and the straight edge on the geison revetment include frieze B from Naxos²¹ and roof 8 from

Selinus.²² Both date to the same period as frieze A and D from Akragas. However, the anthemion sima and geison revetment fragments from Naxos show straight edges on both the sima and geison pieces.²³ Other examples that do not match the ones from Akragas in terms of the side edges include roof 12 from Selinus, which has a stepped edge on the geison revetment fragments instead.²⁴

Table 4.4-1: The side edge used for sima and geison revetment for the different stylistic groups (section 4.1)

Stylistic group	Sima	Geison revetment
Frieze A	Stepped edge	Straight edge
Frieze B3	Stepped edge	Unknown
Frieze B5	Stepped edge	Unknown
Frieze D	Stepped edge	Straight edge
Frieze G	Straight edge	Straight edge

The stepped edge on the sima creates a more secure connection in that it has the potential to restrict differential movement between two tiles. This feature helps to prevent two adjacent tiles from moving out of line in both the horizontal, but especially the vertical plane (figure 4.4-7). In this regard the stepped edge facilitates more stability. It should also be noted that the adjoining pieces, especially the horizontal tile section, provides additional resistance to movement. By linking the tiles more securely in this manner, it ensures that the individual tiles stay in position thereby creating a clear overall profile along the roof edge. In contrast, the geison revetment profile is less complex than the canonical Sicilian sima and its position in the roof might be more stable due to the weight of sima resting on top. This might explain the lack of a complicated stepped edge on geison revetment pieces from Akragas. An additional advantage of

²² Conti 2012, p. 95. fig 63, 72.

²³ Fragments are on display in the archaeological museums of Syracuse and Naxos (Ciurcina 1993, pp. 34-35, fig 14-16).

²⁴ Conti 2012, pp. 107-108, fig 89.

²¹ Lentini & Pakkanen 2011, p. 419, fig 3.

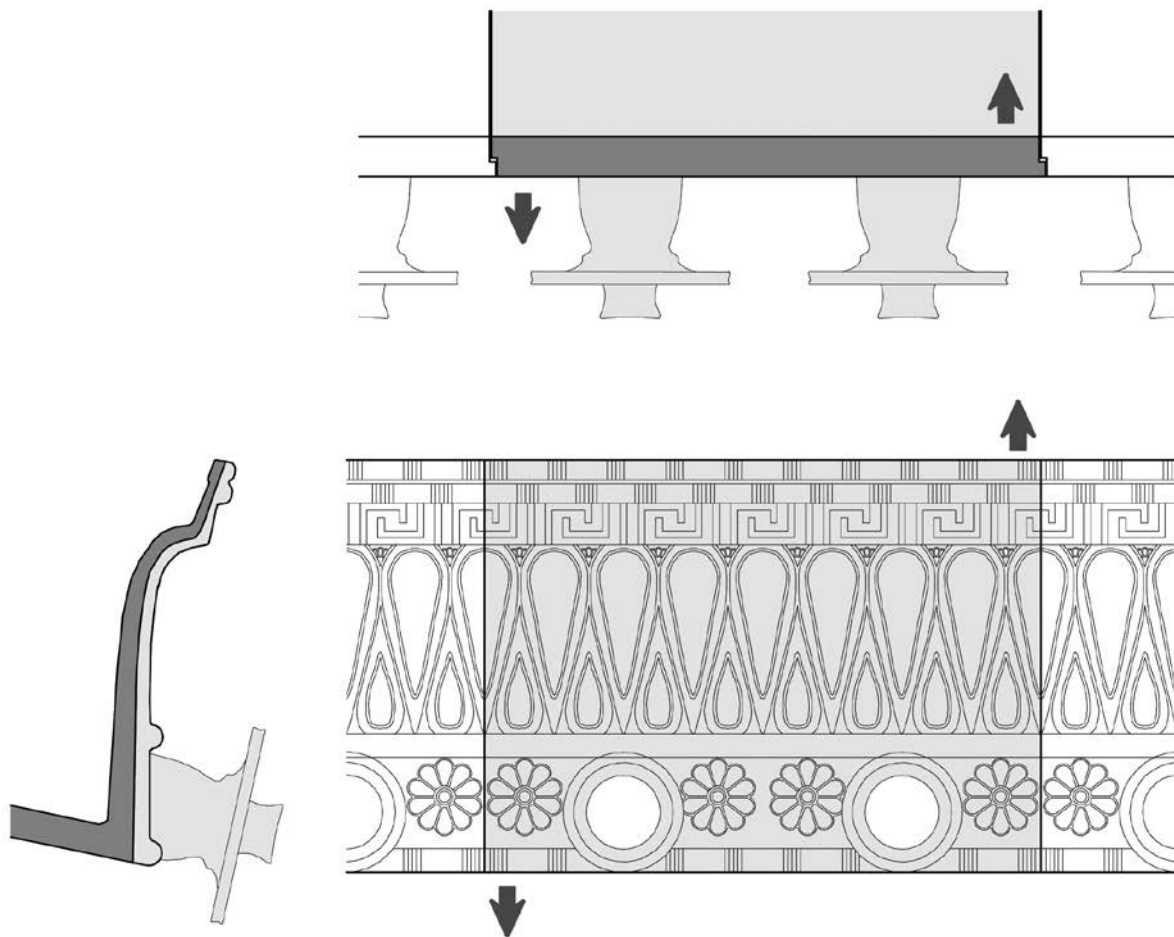


Figure 4.4-7: The stepped joint partially prevents movement in the horizontal plane (top image) and vertical plane (bottom image). The restricted movement is indicated by arrows.

the stepped edge on the sima is the visual shading of the joint due to overlapping elements. The sima upstand is backlit against the sky during parts of the day. A large vertical gap between two sima tiles will thus be highlighted if there is a clear line of sight between the tiles. The stepped edge prevents this from happening in addition to its stabilizing function. In contrast, the geison revetment pieces are placed directly against the wall, and thus there is no backlighting.

The full sima profile including the horizontal tile section is not very well documented. A view of the back side of sima fragments is sporadically published and the full extent of the sima piece is rarely reconstructed.²⁵ In the few instances, where the connection between lateral sima and pan

tiles from the Western Greece are described, the sima tile shows the same profile dimensions as a regular pan tile. The side ridges of the horizontal tile profile terminate against the sima upstand, and the gap between two tiles is protected by a cover tile. The reconstruction of the Geloan treasury roof by Kunze and Schleif is a good example of such a reconstruction.²⁶ Other known sima tiles with a raised border include an earlier roof from Himera dated to 570 BC,²⁷ and the anthemion roof from Naxos dated to the end of the 6th century BC.²⁸ From Southern Italy, there is an example of a canonical sima from Caulonia.²⁹ Another sima fragment from Himera, dated to the first half of the 6th century, also has a raised border, but on the

²⁵ Of the 28 sima profiles published by Wikander, only 4 include the full extent of the horizontal tile portion (Wikander, 1986).

²⁶ Kunze & Schleif 1944, p. 89, fig 24.

²⁷ Lang 2010, p. 98, tab. 6.2.

²⁸ Ciurcina 1993, p. 34, fig 14.

²⁹ Barellò 1995, p. 62, fig. 32.

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Figure 4.4-8: Back of corner fragments of lateral sima fragments associated with frieze A (VIN 260), frieze B3 (VIN 358) and frieze D (VIN 508)(Copyright for VIN 260 and 358: Regione Siciliana – Assessorato Reg.le dei BB. CC. e I. S. – Su concessione del Polo Regionale di Agrigento – Museo Archeologico “Pietro Griffo” – divieto di duplicazione con qualsiasi mezzo. Copyright for VIN 508: Regione Siciliana – Assessorato Reg.le dei BB. CC. e I. S. – Su concessione del Polo Regionale di Palermo per i Parchi e i Musei Archeologici– Museo Archeologico Regionale “Antonino Salinas” – divieto di duplicazione con qualsiasi mezzo)

published image it appears that it does not extend all the way to the sima upstand.³⁰

Evidence for the profile of the tile portion of the sima pieces from Akragas is limited to fragmentary remains directly next to the sima upstand. The best indication comes from the bottom corners of lateral sima pieces. There are such corner fragments available for three of the stylistic groups, frieze A, B3 and D (figure 4.4-8). The preserved fracture on these objects indicates a tile with an overall thickness of 30 mm, or slightly less, which is consistent with known pan tiles from Akragas (section 4.1.62-65). The preserved fracture of the tile portion proves a uniform thickness for the entire extent of each fragment. While the presence of a raised border cannot be ruled out, the available evidence shows that there was no raised border which connected to the upstand sima.

One of the reasons might be due to the relatively small size of simas from Akragas. The distance from the edge of the sima to the inside of the waterspout is around 100 mm for all three frieze examples. Depending on the size of the pan tile profile in use, the cover tile might have partly obscured the waterspout hole if it extended all the way to the sima upstand. On the roofs at Selinus, the cover tile needed to overarch the connection between two pan tiles with a ridge of 70 mm width is 200 mm.³¹ However, this example is dated later than the canonical roof systems from Akragas from the middle of the 6th century, of which the pan tile profiles are not known. Earlier pan tile profiles from Selinus from the 6th century have a raised ridge of 55 mm wide,³² whereas the earliest identified pan tile from S. Anna shows a raised border of 100 mm (section 4.1.64). In the absence

30 Allegro, 1976, pp. 537, Tab. LXXXVI.1; Lang 2010, pp. 101, HIM 12;.

31 Jonasch 2009, p. 4.

32 Conti 1998, pp. 216-219.

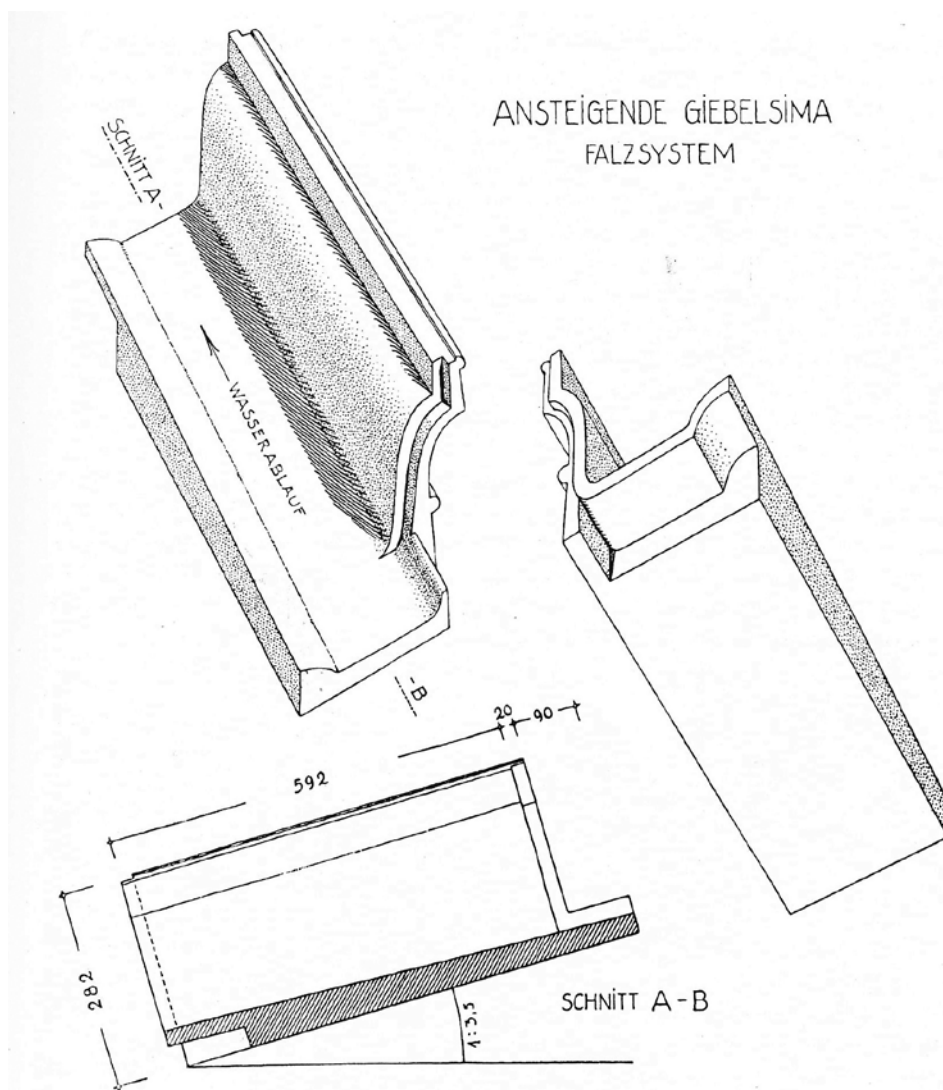


Abb. 30. Schatzhaus von Gela

Figure 4.4-9: Detail of raking sima from the Geloan treasury, Olympia
(Kunze & Schleif 1944, fig 30).

of clear evidence regarding the profile dimensions of the pan tiles associated with these roofs it is not possible to clarify if the lack of raised edges on the sima is due to insufficient space between the sima edge and waterspout.

The connection between the raking sima and pan tiles is still less known than the one for the lateral sima. The reconstruction of the Geloan treasury roof at Olympia represents one of the few examples. Here the lateral sima is reconstructed as having a raised border at the back edge in order to mirror the adjacent pan tile.³³ Another example comes from Selinus, identified as roof 3, and is dated to

³³ Kunze & Schleif 1944, pp. 89, fig 24.

the end of the first quarter of the 6th century BC by Conti. This roof has a small raised border at the back edge of the horizontal tile.³⁴ From Caulonia in Southern Italy, another well published example presents a raised border with a profile similar to pan tiles. The roof offers similarities with the canonical Sicilian roof and is dated to the second half of the 6th century.³⁵ In summary, the connection of both elements is best explained in the reconstruction and detailed drawing of the raking sima of the Geloan treasury roof by Kunze and Schleif (figure

³⁴ Conti 2012, pp. 63, fig. 41; Wikander 1986, pp. 40, fig. 11.

³⁵ Barello 1995, pp. 66-68, fig 35; Lang, 2010, pp. 102-103, tab. 7.5.

Table 4.4-2: The angle between the vertical face and the horizontal tile for stylistic groups (section 4.1).

		Canonical Sicilian sima					Anthemion sima	
	VIN	Frieze A	Frieze B1	Frieze B2	Frieze B3	Frieze D	Frieze F	Frieze G
Lateral sima	177						93	
	196					84		
	253	75						
	257	75						
	260	75						
	261	76						
	265	77						
	267	77						
	349			81				
	355	78						
	358				79			
	508					78		
	562				76			
	569				77			
	612					76		
	Average	76		81	77	79	93	
Lateral geison	183							93
	351		99					
	354	97						
	505					98		
	570				100			
		Average	97	99		100	98	
	Total	173			177	177		

4.4-9).³⁶ The section of the bottom tile portion shows that it changes in thickness and has a notch at the bottom thereby facilitating the connection between the pan tiles of the main roof and the raking sima. As already discussed and illustrated in section 4.4.2.1, the overlap between pan tiles means that each of these objects is at a different angle than the overall roof slope (figure 4.4 2). As another result, this overlap also creates a step in the profile of the lower tile portion of the sima. In contrast, the known raking sima fragments from Sicily generally form a continuous straight

line that follows the slope of the pediment.³⁷ The Geloan treasury at Olympia is the only published example of a fully detailed raking sima, where the difference in thickness of the raking sima tile thus accommodates the difference in slope between the pan tiles and the raking sima.

The connection between the sima and geison revetment varies according to the type of roof and the position of the objects. The established convention used by scholars on the canonical

³⁶ Kunze & Schleif 1944, tab. 47.

³⁷ The Geloan treasury at Olympia (Kunze & Schleif 1944, tab. 47); Frieze A from Gela (Brea 1949, tab. 2); "Secondo Nucleo" from the Athenaion, Syracuse (Orsi 1918), fig 233; (Wikander 1986, pp. 44-46, fig 2,15).

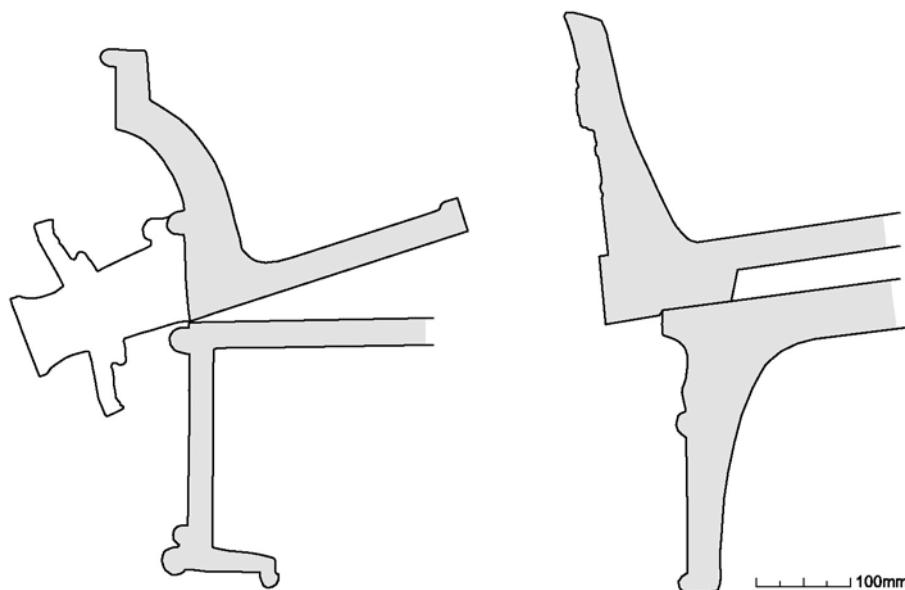


Figure 4.4-10: The placement of the lateral sima and geison revetment for a) the canonical Sicilian roof, represented by the Geloan treasury at Olympia (after Heiden 1995, fig 33-34), and for b) the anthemion roof, represented by roof 20 from Selinus (after Conti 2012, fig 186).

Sicilian roof is to depict the lateral sima with the lower fascia as vertical, seen in the profile drawing of the Geloan treasury roof at Olympia (figure 4.4-10a). In contrast, the raking sima is depicted with the bottom tile portion as horizontal, which places the bottom fascia at an angle. This is the convention also followed for the graphic reconstruction of the roofs from Akragas in chapter 5. The geison revetment from the lateral, raking and horizontal parts of the roofs are all depicted with the main fascia completely vertical. This way, the sima is placed directly in line with the geison revetment.³⁸ The angle between the vertical face and horizontal tile for the lateral sima and geison revetment is summarized in table 4.4-2. For the canonical Sicilian roofs (frieze A, B2, B3 and D), this angle on the sima fragments is considerably smaller than 90 degrees, while on the geison revetment fragment it is larger than 90 degrees. The sum total of the angles for the sima and geison revetment pieces are less than 180 degrees. This means that if the sima and geison revetment is placed according to the convention, there is a gap between the sima and geison revetment tile of a couple of degrees, as

seen in the profile drawing for the Geloan treasury (figure 4.4-10a).

The connection and placement of the lateral sima and geison revetment for the anthemion roof (frieze F and G) differ slightly from the one of the canonical Sicilian roof. As seen in table 4.4-2, the angle between the vertical and horizontal parts of the sima is more than 90 degrees. This means that if the lateral geison revetment has an angle of more than 90 degrees, the sum angle of the sima and geison revetment is also slightly more than 180 degrees. This raises the question if there was a gap between the sima and geison revetment, as seen for the canonical Sicilian sima. The profile reconstruction for roof 20 from Selinus (figure 4.4-10) shows no such gap. While the fragments from Akragas are not preserved in full profile, the available evidence appears to correspond to the known profiles for anthemion roofs from Sicily in terms of the positioning of the lateral sima and geison revetment.³⁹ The angle of the lateral sima of frieze F is similar to roof 20 from Selinus and the painted soffit on VIN 177 is indicative of a

³⁸ Conti 2012; Wikander 1986.

³⁹ Roof 20 from Selinus (Conti 2012, fig 186) and series A from Naxos (Ciurcina 1993, fig 14).

cantilever beyond the lateral geison revetment.

The knowledge of the placement of sima and geison revetment pieces in relation to each other along the façade of the building is limited. The connection can only be conclusively determined in the rare instances where complete sima and geison revetment corner pieces are available. The Geloan treasury at Olympia is again one of the few examples. In the reconstruction of the front of the roof, the sima corner fragment is longer in relation to the length of geison revetment corner. This means that the join between two raking sima pieces does not line up with the join between two raking geison revetment fragments.⁴⁰ This variation is also found at another Olympian roof with tubular waterspouts.⁴¹ It can be hypothesized that the staggering of sima and geison revetment joins, known from the two examples from Olympia, was also used for the roofs from Akragas. The painted black line on the top corner of the horizontal flange of geison revetment on VIN 276 (figure 4.4-1) might be associated with the placement according to the sima join: this black line is about 60 mm from the left edge of the geison revetment. If the sima is placed on top of it with the corner on this line it will stagger the sima and geison revetment joins by 60 mm. On the underside of two corner fragments from the lateral sima, similar black lines are visible around 30 mm from the right corner (VIN 260-261). These fragments are all associated with frieze A (section 4.1.1), and, therefore, indicate that at least for this frieze the sima and geison revetment joins were staggered. This has implications for the management of water seepage discussed in section 5.3.

CONCLUSIONS

The connections between individual terracotta roof elements are integral to the successful function of the roof in terms of structural stability and durability, waterproofing and protection of underlying structures as well as uniform painted decoration. A systematic evaluation of the interconnections is therefore a key step in analyzing the architectural context of terracotta roofs. The functional and technical understanding of the objects is a principle point for creating accurate graphic reconstructions in chapter 5. Unfortunately this aspect of architectural terracottas has not received wide spread academic interest (section 2.1), as attested by the lack of published photographs or drawings showing, for example, the back side of objects or the full profile or the horizontal tile sections. The objects from Akragas do not present all aspects of the terracotta roof elements discussed above and the evidence is therefore limited. For instance, the sima and geison revetment corner pieces as well as the lateral sima profile is not preserved. However, the reevaluation of different evidence such as numbering and construction marks, the scars left by missing elements and the finishing of adjoining objects' sides provides additional information which contributes new details to the reconstruction of connections and to the wider discussion on architectural function.

Based on the detailed review in this chapter, it is apparent that the solutions used for addressing specific technical requirements change over time, especially between the canonical Sicilian roofs of the mid-6th century and the anthemion roofs of the late 6th century. The majority of connections between different terracotta roof elements rely on overlapping and notching elements in order to protect joins but also to provide additional stability to the roof. The overlap between pan tiles is one solution, as are the side edges of some sima pieces. These stepped joins between the sima pieces are only found on the earlier canonical Sicilian roof examples, not on the later anthemion sima. In

⁴⁰ Kunze & Schleif 1944, tab. 47-9.

⁴¹ The roof with rosettes as reconstructed by Winter (Winter 1993, fig. 26)..

relation to the supporting structures, the canonical Sicilian sima also differs from the other roof type in that there is a gap between horizontal elements of the sima and geison, which means that the sima only rests on its edge against the geison revetment. Furthermore, the discharge of water from the roof is achieved differently between the two roof systems as can be seen with the interconnections of sima, pan and cover tiles. On the canonical Sicilian sima the water is funneled away from the building surfaces by means of the tubular waterspouts. On the anthemion roof the perforated sima cantilevers beyond the supporting structures, which protects the building surfaces below from damage caused by water runoff. The full extent of the measures taken to protect against water seepage will be discussed in greater detail in chapter 5 in light of the new roof typologies.

As architectural components the shape of individual terracotta roof elements is designed to fit within a specific position on the building. Their different interconnections are carefully considered and incorporated into the final form. Even before firing the placement of individual elements is already tested and adjusted. The architectural function of these terracottas therefore constitutes an integral factor in the design and production of the objects.