POTTERY PRODUCTION AND CONSUMPTION IN EARLY IRON AGE CRETE: THE CASE OF THRONOS KEPHALA (ANCIENT SYBRITA)[1]

by Anna Lucia D'Agata and Marie-Claude Boileau

1. Introduction

Recent years have seen a marked increase in interest in the Early Iron Age of Crete (Fig. 1), focusing on sites which flourished in the centuries of the so called Dark Ages through to the emergence of the city-states dating from the 8th century BC onwards. Excavations at Knossos, Eleutherna, Thronos Kephala, and Kavousi, and surveys at Vrokastro and elsewhere bear witness to this renewed interest. Still, our understanding of regionalism within Crete in this period remains poor[2], partly because ceramic studies of Early Iron Age material have mostly concentrated on the stylistic development of fine decorated wares from funerary contexts as an aid to chronological studies. Local developments of, and interactions between, sites and regions can be documented more precisely through the study of pottery technology, production and circulation with the application of analytical techniques[3].

Here we present the first detailed assessment of Early Iron Age pottery production and consumption from Thronos Kephala (ancient Sybrita). Using mainly ceramic petrography, it sets out to establish the compositional reference fabric groups for the local coarse, semi-fine and cooking pot productions, and to identify non-local fabrics. Results of the integrated petrographic and typo-chronological data shed light on issues of clay paste technology, diachronic patterns of local production and consumption, provenance of non-local pottery and, more generally, on the relationship between Thronos Kephala and the other communities of west-central Crete. Greek-Italian excavations at the site of Thronos Kephala, generally identified with Minoan su-ki-ri-ta and the forerunner of the Classical *polis* of Sybrita,

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[2] A joint work on this subject by M.-C. Boileau, A. L. D'Agata and J. Whitley is in preparation.

[3] Day, Kiriatzi, Tsolakidou, Kilikoglou 1999; Wilson, Day 1994.

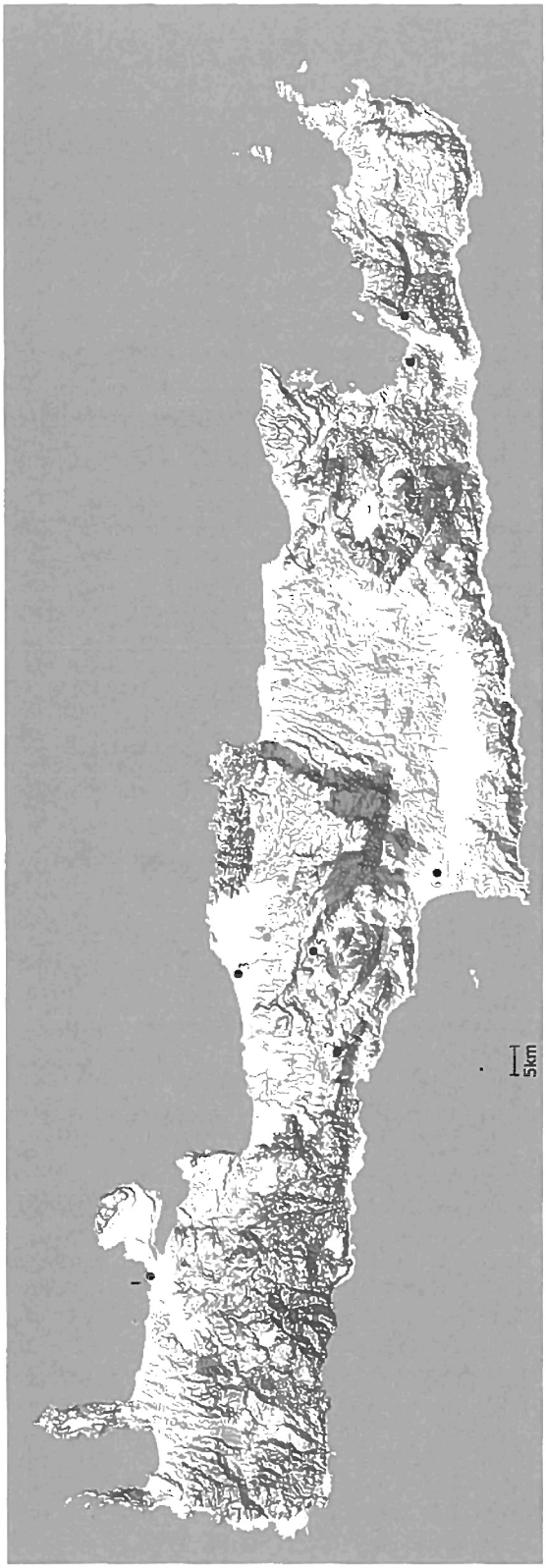

Fig. 1 - Map of Crete with indication of the major sites mentioned in the text. 1 Khania; 2 Atsipadhes; 3 Khamalevri; 4 Eleutherna; 5 Thronos Kephala; 6 Phaestos; 7 Knossos; 8 Vrokastro; 9 Kavousi.

have uncovered a settlement which was continuously occupied from the 12th to the 7th century BC[4]. The settlement (Fig. 2), situated on the summit of the hill of Kephala on the south-western slopes of the Psiloritis and at the northern end of the valley of Amari, was founded in LM IIIC Early, just after the collapse of the Late Bronze Age system of autonomous polities, and was destroyed in the course of the 7th century BC. The excavated area consists of three sectors: the north and the south plateaux, and a central area close to the hilltop, linking the two plateaux. In the central area

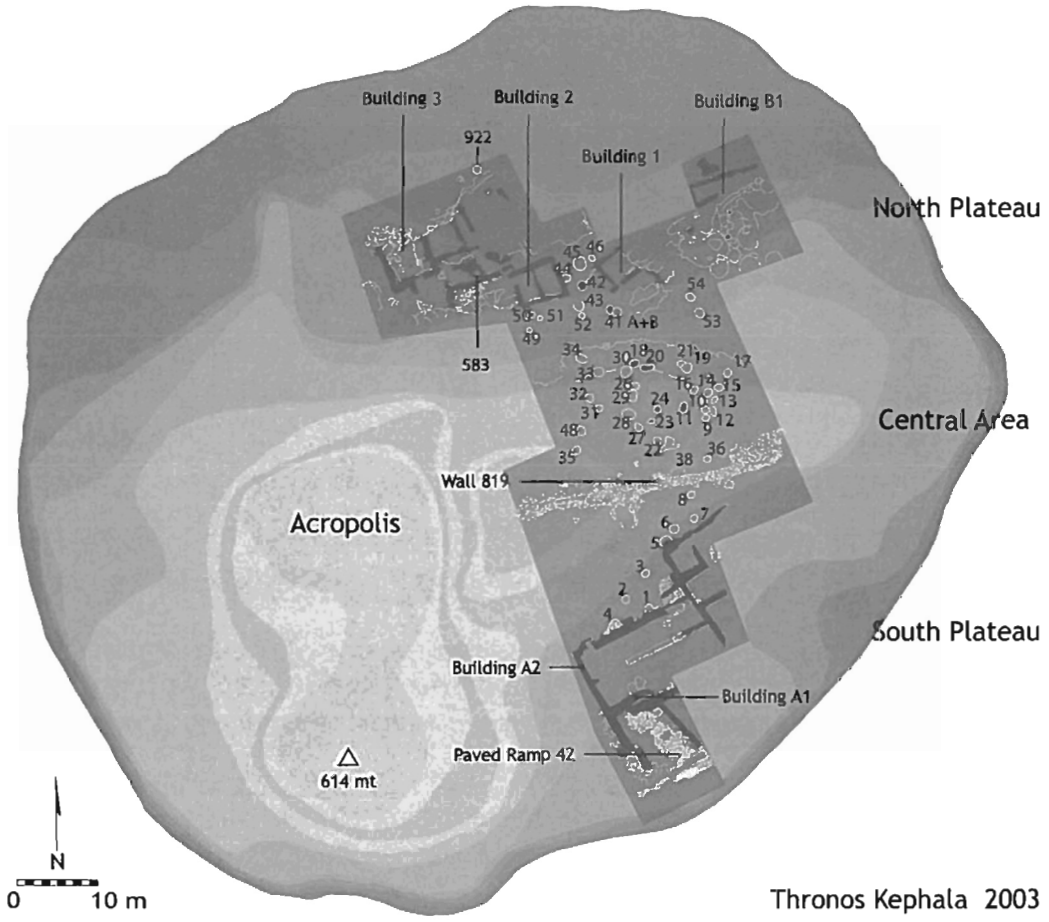

Fig. 2 – Plan of the settlement on the summit of Kephala at the end of the 2003 excavation season.

[4] Prokopiou 1991; Rocchetti 1994; Prokopiou 1997; D'Agata 1999; 1997-2000; 2000; 2003; 2007; 2008a; 2008b; forthcoming a; forthcoming b; forthcoming c. See also www.sybrita.icevo.cnr.it. On the chronological nomenclature of the 12th and 11th century BC adopted here – which includes LM IIIC Early, LM IIIC Late, SM I and SM II – cf. D'Agata 2007.

more than 40 pits dug in the bedrock have been unearthed. The remains of the settlement include, on the north plateau, Building 1, 2, 3, and the large, and later, Building B1; on the south plateau, Building A1. The pits constitute a defining feature of the settlement on Kephala, unparalleled on such a scale anywhere else in Crete. The central area, being occupied by the pits, remained substantially untouched by later constructions up to the Roman period. The way in which the pits were filled in indicates that they were the outcome of ritual behaviour practised by the inhabitants of the Kephala uninterruptedly from the 12th to the 9th century BC, and the awareness of their existence seems to have persisted throughout the following centuries. To judge from the materials collected in the pits themselves – mainly including pottery, animal bones, and organic remains – this behaviour involved the careful burial of the remains of the preparation and consumption of food, and to a lesser extent the manipulation of liquids. In other words we are dealing with structured deposits reflecting specific deposition modalities. The pits contained the remains of collective meals which took place on Kephala between the 12th and the 9th century BC and which were invested with a ritual value. These collective meals may be seen as the forerunner of the *syssitia,* one of the most important institutions of the Cretan *poleis* in the Archaic period. The ceramic material from the pits is domestic in nature, and includes fine, coarse and kitchen ware. Being prevalently closed contexts, the ritual pits of the central area also correspond to a sort of horizontal stratigraphic sequence ranging in time from LM IIIC to late Protogeometric. The archaeological evidence from Thronos Kephala includes numerous indications which show how during the Dark Ages the embryo of practices which proved crucial for archaic Cretan society, such as meals taken in common, was already to be found here. The investigation of this site constitutes an integrated project for reconstructing the socio-economic processes which during the Dark Ages transformed a small hilltop settlement in one Cretan *polis* from the Archaic period[5].

The questions addressed in this study deal essentially with issues of provenance and technology of coarse-grained pottery. Thin-section petrography using a polarising microscope was thus chosen as the most appropriate analytical technique. The analysis was carried out at the Fitch Laboratory and following the methodology proposed by Whitbread[6]. A total of 200 pottery samples were selected for thin-section petrography, representing the range of macro-fabrics (Fig. 3), vessel types, vessel size, typo-chronology and depositional contexts (Table 1) at Thronos Kephala. Refiring tests were conducted so that variations in clay colour due to ancient firing conditions were eliminated. A second phase of the project on the geochemistry of 12 clays and 75 samples of semi-coarse to semi-fine wares by neutron activation analysis is currently underway[7].

[5] See especially D'Agata forthcoming b.

[6] Whitbread 1986; 1989; 1995.

[7] In collaboration with V. Kilikoglou, National Centre for Scientific Research 'Demokritos', Athens.

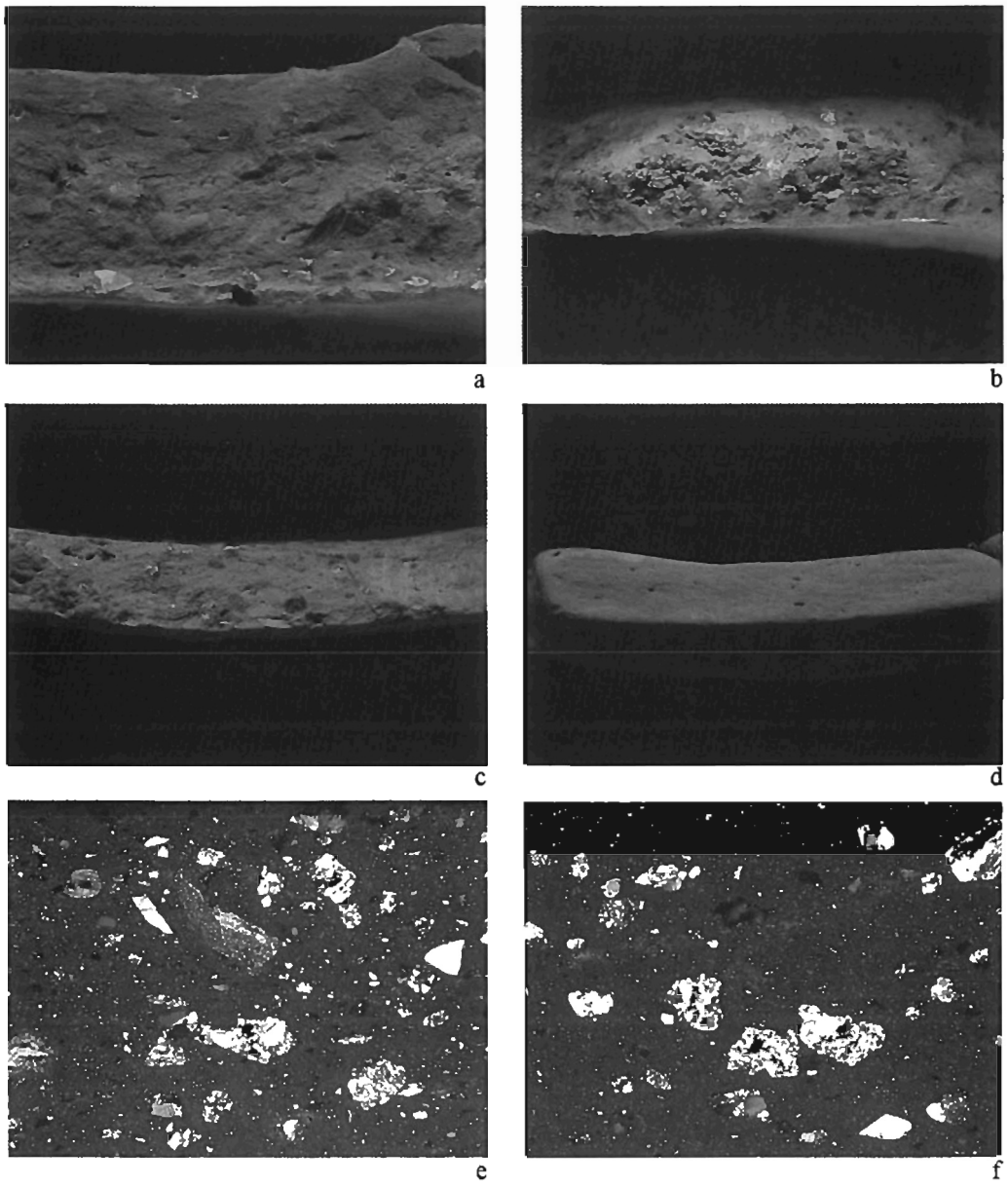

Fig. 3 – Thronos Kephala. a. Coarse-grained macrofabric of a local coarse ware vase (SY161); b. Coarse-grained macrofabric of a local cooking pot (SY36); c. Medium-grained macrofabric of a local coarseware vase (SY1); d. Fine-grained macrofabric of a local fine ware vase (SY35); e. Group 1a, low-grade metamorphic (SY111, XPL, field of view 9 mm); f. Group 1b, low-grade metamorphic with light grey core (SY44, XPL, field of view 7.4 mm).

Sample	Context
SY1	Pit 54/16
SY2	Pit 54/1
SY3	Pit 1/13
SY4	Pit 1/16
SY5-10	Pit 3
SY11	Pit 3/6
SY12	Pit 36/49
SY13	Pit 36/14
SY14-20	Pit 20
SY21-26.	Pit 41
SY27-30	Pit 41b
SY31-33	Pit 2
SY34-35	Pit 10
SY36-40	Pit 17
SY41-42	Pit 10
SY43	Pit 53, THK99/125 (=53/21)
SY44-49	Pit 53
SY50-51	Building 2, US 156
SY52	Tafros 40
SY53-59	Pit 36
SY60-66	Building 2, room 3a
SY67	Tafros 39, THK06/41
SY68	Building 2, room 3a
SY69-70	Pit 29
SY71	Pit 29/10
SY72	Pit 29
SY73	Pit 29/16
SY74-84	Pit 29
SY85	Pit 29/21
SY86	Pit 29
SY87-90	Pit 30
SY91	Pit 30/14
SY92	Pit 30/21
SY93	Pit 30
SY94	Pit 30/6
SY95	Pit 30/5
SY96-98	Pit 30
SY99	Building 2, THK06/97
SY100	Building A1, THK04/54

Table 1. List of samples SY1-200 with indication of context

SY101-116	Building A1, US 17
SY117-129	Building B1, US 436
SY130-138	Building A1, US 63
SY139	Building A1, US 64, THK99/106
SY140	Building A1, US 64, THK99/52
SY141	Building A1, US 64, THK99/53
SY142	Building A1, US 64, THK99/101
SY143	Building A1, US 57, THK99/320
SY144-148	Building A1, US 57
SY149	Building A1, US 68, THK99/223
SY150	Building A1, US 64, THK99/110
SY151	Building 3, US 530/550, THK02/106
SY152	Building 3, US 530/550, THK02/ 102
SY153	Building 3, US 530/550, THK02/103
SY154	Building 3, US 530/550, THK02/104
SY155	Building 3, US 530/550, THK02/105
SY156	Building 3, US 530/550
SY157	Building 3, US 550
SY158	Building 3, US 530/550
SY159-162	Building 3, US 527/550
SY163	Building 3, US 528/535/710, perhaps belonging to THK02/1
SY164	Building 1, 90-32/33/4/93
SY165	Building 1, 90-32/33/4/65
SY166	Building 1, 90-32/33/4/21
SY167	Building 1, 90-32/33/4/72
SY168	Building 1, 90-32/33/4/24
SY169	Building 1, 90-32/33/4/36
SY170	Building 1, 90-32/33/4
SY171	Building 1, 90-32/33/4/124
SY172	Building 1, 90-32/33/4/121
SY173	Building 1, 90-32/33/4/7
SY174	Building 1, 90-32/33/4
SY175	Building 1, 32/33/4/63
SY176	Building 1, 32/33/4/67
SY177	Building 1, 90-32/33/4b/9
SY178	Building 1, 90-32/33/4/126
SY179	Building 1, 90-32/33/4/127
SY180-199	South Plateau, US 73
SY200	South Plateau, US 45, THK99/388

Table 1. List of samples SY1-200 with indication of context

2. Geology of the area

Thronos Kephala is located in an area characterised by Neogene continental deposits of conglomerates, sandstones, clays and outcrops of the Phyllite-Quartzite series composed of shale, phyllites, quartz-phyllites, and quartzite. Alluvial clays and sand of calcareous and phyllitic composition are also found in the vicinity of the site[8]. To the east, there is the Upper Jurassic-Lower Cretaceous formation of dark grey to grey, usually micritic, medium to thin-bedded limestones and dolomites as well as the Middle Eocene Ionian Zone of limestones with chert. Miocene and Lower Cretaceous-Cenomanian formations of the Pelagonian Nappe and Vatos Nappe both characterised by ophiolitic rocks (ultrabasic and basic rocks, pseudoconglomerates, consisting of peridotites locally serpentinised, gabbros and diorites) and schists (shales, hydromica-mica, chlorite and quartzite schists with phyllite intercalations) and greenstones are found west at the beginning of the Aghios Vasileios valley near the modern town of Spili. The main schist minerals are: biotite, white mica, hydromuscovite, chlorite, chloritoid, sericite, quartz, albite, calcite, glaucophane and lawsonite. The greenstones, which derive from the metamorphism of basic volcanic rocks, consist of prasinites, glaucophane and epidotites (zoisite, clinozoisite, pistacite). A geological prospection provided additional information on available potting raw material sources within the vicinity of the site and in the main drainages of west-central Crete. A total of 28 geological samples, including 12 clays, were collected in the Potamies, Amari and Aghios Vasileios valleys, and subsequently analysed under the microscope. These geological samples acted as comparative material in assigning areas of production.

3. Petrographic data: the analytical results

Based on the mineralogy of the non-plastic inclusions, grain-size distribution, colour and optical activity of the micromass, the 200 pottery thin sections were classified into seven main fabric groups and associated subgroups (Table 2). In addition, 16 petrographic loners have been identified. Detailed description of each group is provided in the Appendix.

GROUP 1 Coarse-grained orange fabric with phyllite-quartzite
82 samples

This is a coarse-grained fabric characterised by large low-grade metamorphic inclusions set in a rather fine orange clay base. The inclusions have a bimodal grain-size distribution. Together with phyllite and quartzite, there are schist, quartz, chert, calcimudstone, and rare feldspar, sandstone and serpentinite inclusions. These minerals and rock fragments are compatible with the local geological outcrops, especially that of the Phyllite and Quartzite Series. The orange-firing clay base could be the result of a deliberate mix of Neogene and red iron-rich metamorphic clays, of which both clay types are found near the site. The clay base could also be

[8] IGME 1985; 1991.

naturally occurring, possibly from the alluvium deposits of phyllitic and calcareous component also present in the vicinity of the site but not sampled in the geological prospection. Overall this large fabric group is rather heterogeneous based on the varying amount of fine fraction and sand-sized inclusions. The subdivision into the first two subgroups, 1a and 1b, is based on the difference in the firing procedure while Subgroup 1c represents the coarser end of the fabric with pithoi samples.

Subgroup 1a

The fabric is well fired with no core to margin differentiation (Fig. 3e). When compared to the experimental clay briquettes, especially SGS 5, the pottery samples' orange brown micromass, low or absent optical activity and loss of iron of phyllite inclusions attest to high firing temperatures. Those dating to the later periods tend be fired at a lower temperature.

Subgroup 1b

This fabric exhibits a grey core and thin orange margins, which is the result of a fast firing with incomplete oxidisation of the clay walls (Fig. 3f). In contrast to Subgroup 1a, the members of 1b have a nearly absent fine fraction. The variation in coarseness of the non-plastics displayed among the samples of this group relate to the size of the vessel. A number of fine-grained samples were kept within this group as SY190 exhibits both a coarse and a fine fabric.

Subgroup 1c

These samples, all belonging to the category of large storage vessels, have a brown, relatively well-fired micromass, scarce fine fraction and very coarse sand-sized low-grade metamorphic inclusions (Fig. 4a). The amount of yellow phyllite is higher in these samples than in Subgroups 1a and 1b.

GROUP 2 Coarse-grained red fabric with phyllite-quartzite
27 samples

This iron-rich metamorphic fabric represents the local Thronos Kephala production of cooking pots. The red-firing clay paste has an abundant quartz-rich fine fraction with coarse inclusions of metamorphic rock fragments, principally quartzite. It is characterised by quartzite, phyllite, schist, feldspar, mudstone, chert, calcimudstone, feldspar-quartz rock fragment, and traces of glaucophane. It is consistent with the local geological units and differs from *Group 1* in its higher amount of quartzite inclusions. The local attribution of this fabric is strengthened by the almost identical texture and mineralogy of the red metamorphic clays sampled near the site, especially SGS 8. The samples, all displaying the same texture and mineralogy of the coarse fraction, are subdivided into three subgroups based on firing and the presence of red TCFs within the micromass. The surface of SY171 was covered in a thin layer of fine organic tempered calcareous clay.

Fabric Group	*n*	*LM III C*	*SM I-II*	*PG*	*G/EO*
Group 1: Orange fabric with phyllite-quartzite	82				
Subgroup 1a	36	SY 1, 3, 15, 18, 166, 167	SY 21, 22, 25, 26, 28, 31, 32, 33	SY 38, 41, 45, 48, 61, 63, 157, 160, 191	SY 107, 111, 112, 117, 121, 125, 130, 133, 136, 137, 138, 145, 150
Subgroup 1b	37	SY 4, 17, 19, 170, 177	SY 24	SY 37, 39, 42, 43, 44, 46, 64, 65, 66, 73, 75, 80, 89, 93, 161, 180, 181, 183, 184, 186, 187, 188, 190a/b, 192	SY 122, 131, 140, 141, 142, 144, 147
Subgroup 1c	9	SY 51		SY 76, 77, 78, 85, 88, 90, 91	SY 116
Group 2: Red fabric with phyllite-quartzite	27				
Subgroup 2a	19	SY 53, 55, 56, 57, 58, 59, 171, 172, 178, 179	SY 30	SY 34, 36, 82, 86	SY 106, 132, 134, 135
Subgroup 2b	5			SY 83, 194, 196, 197, 198	
Subgroup 2c	3		SY 27	SY 97	SY 127

Fabric Group	*n*	*LM III C*	*SM I-II*	*PG*	*G/EO*
Group 3: Mica-epidote schist	17				
Subgroup 3a	10	SY 2, 5, 6, 9, 16, 168		SY 40, 47, 79	SY 126
Subgroup 3b	7			SY 49, 84, 87, 96, 98, 162	SY 108
Group 4: Garnet schist	8	SY 7, 14, 20		SY 156, 189	SY 114, 115, 119
Group 5: Calcareous fabric	18	SY 12, 164, 175, 176		SY 62, 70, 71, 72, 74, 81, 94, 152, 158, 163, 182, 185	SY 103, 124
Group 6: Fine grained fabric	26	SY 10, 13, 50, 165, 169, 173, 174	SY 23	SY 35, 69, 95, 151, 153, 154, 155	SY 102, 104, 105, 123, 128, 129, 139, 143, 146, 149, 200
Group 7: Black TCFs	6			SY 159	SY 101, 109, 118, 120, 148

Table 2. Petrographic classification of the pottery samples from Thronos Kephala into 7 main fabric groups.

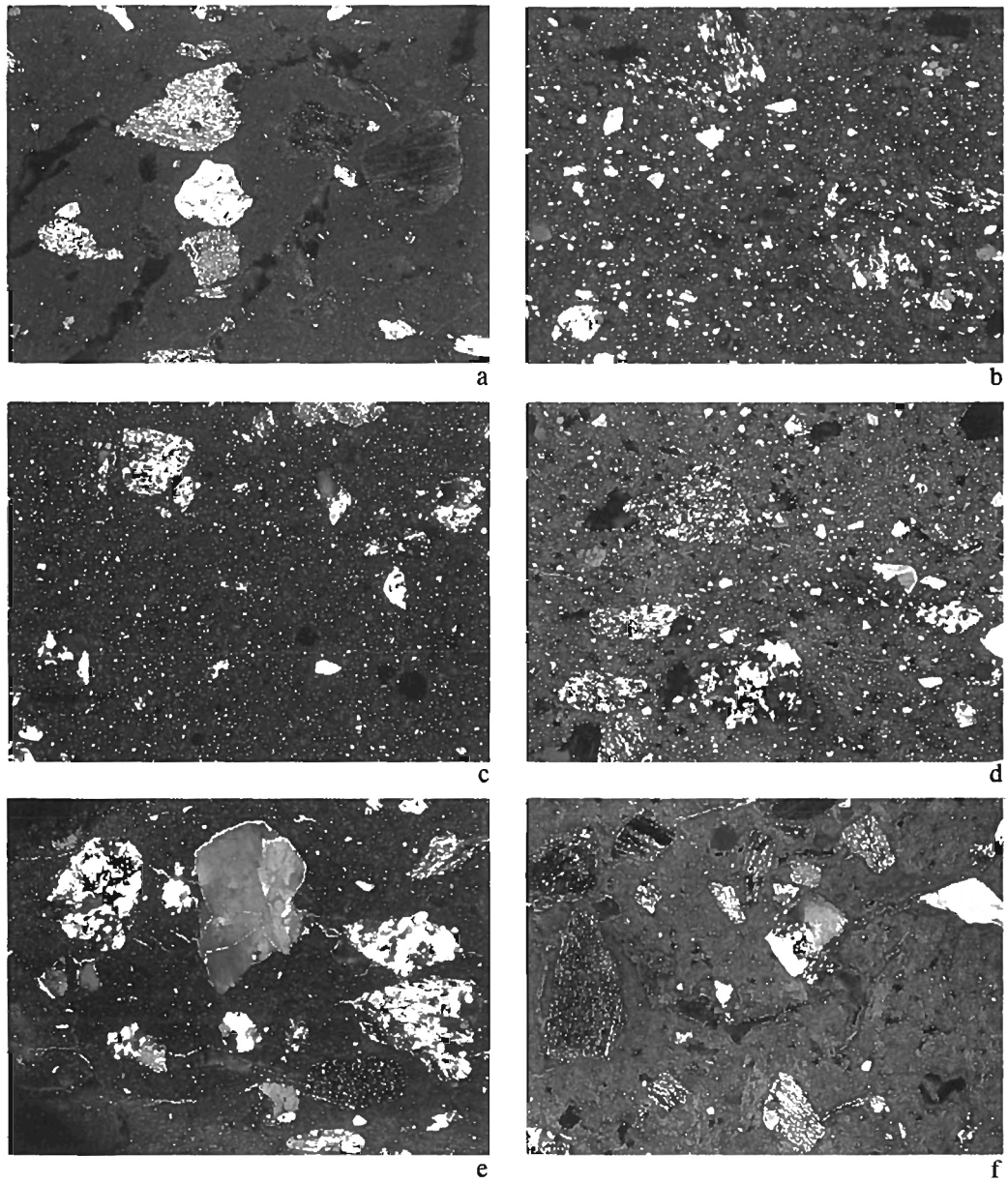

Fig. 4 – Thronos Kephala. a. Group 1c, coarse low-grade metamorphic (SY85, XPL, field of view 9mm); b. Group 2a, coarse low-grade metamorphic with abundant silicate fine fraction (SY132, XPL, field of view 5.9 mm); c. Group 2b, red-firing, abundant silicate fine fraction and red clay pellets (SY197, XPL, field of view 7.4 mm); d. Group 2c, low fired low-grade metamorphic with abundant silicate fine fraction (SY27, XPL, field of view 9 mm); e. Group 3a, muscovite schist (SY126, XPL, field of view 5.9 mm); f. Group 3b, coarse fabric with muscovite schist (SY162, XPL, field of view 9 mm).

Subgroup 2a

It is a heterogeneous group based on varying amount of very coarse metamorphic sand and different firing temperatures (Fig. 4b). All samples refired red. Many samples exhibit a slightly darker core as the result of an incomplete oxidisation of the clay wall. This last feature parallels the characteristic light grey core of Subgroup 1b.

Subgroup 2b

This fabric is not so easy to define but it is the presence of red clay pellets, as well as a less abundant coarse fraction, that separates it from Subgroups 2a and 2c (Fig. 4c). The samples are well fired and have no core to margin differentiation.

Subgroup 2c

In contrast with the previous two subgroups, this fabric exhibits a low firing and a pale brown micromass (Fig. 4d). The three samples refired red, attesting to the use of an iron-rich clay. The composition of the fine and coarse fraction is the same as in the other members of *Group 2*.

GROUP 3 Coarse-grained fabric with mica and epidote
17 samples

This is the largest non-local fabric group within the Thronos Kephala assemblage. It is characterised by mica-epidote schist fragments, clinozoisite and serpentinite non-plastics along with phyllitic and quartzitic rock fragments. These inclusions are derived from ophiolitic and greenschist series. Such deposits are not present in the vicinity of the site but occur in the Aghios Vasileios valley, whose associated rock fragments are present in the geological samples collected near the modern town of Spili. However, the origin of this fabric needs to be further investigated as ophiolitic sources outcrop in various areas of Crete, including the southwestern Mesara where similar Bronze Age fabrics with rocks and minerals of the ophiolitic, gneiss and schist series have been identified[9]. The individuals in this group have been subdivided on the grounds of firing and coarseness of inclusions and reflect the production of different functional categories of vessels.

Subgroup 3a

The fabric is medium to well fired and exhibits varying amounts of minerals in the fine fraction (Fig. 4e). Macroscopically most samples have traces of extremely fine mica flakes. SY16, a cooking pot, has an abundant quartz-rich fine fraction and parallels the clay paste technology used at Thronos Kephala for the manufacturing of cooking pots.

[9] Belfiore *et al.*, 2007; Buxeda i Garrigós, Kilikoglou, Day 2001; Myers, Betancourt 1990; Shaw, Van der Moortel, Day, Kilikoglou 2001; Wilson, Day 1994.

Subgroup 3b

This pithoi fabric is characterised by a relatively low fired micromass and very coarse sand-sized inclusions of phyllites and quartzite (Fig. 4f). Apart from its low fired micromass and the occasional presence of mica schist, it strongly resembles the fabric of Subgroup 1c.

GROUP 4 Coarse-grained fabric with altered garnet (?) schist
7 samples

This is a minor fabric group within the Thronos Kephala pottery assemblage. It is closely related to Group 3 based on the ophiolitic rock components and clay base but differs by the presence of altered garnet (?) schist and very rare altered igneous rock fragments (Fig. 5a). It is possible that this fabric reflects the production of yet another workshop or the variability within a geological deposit. This fabric is heterogeneous based on the mineralogy of the coarse-fraction and abundance of minerals in the fine fraction. The presence of altered garnet (?) schist inclusions keeps these samples together.

SY156

The amount of muscovite and biotite schists, and the presence of large fragments of radiolarian chert, separates this fabric from the rest of the group. In fact, this sample points to a very similar ophiolitic source as *Group 3*.

GROUP 5 Semi-fine calcareous fabric
18 samples

This is a very heterogeneous fabric group characterised by the use of calcareous-rich Neogene clays with naturally occurring red TCFs (Fig. 5b). Neogene clays are found in many places on Crete[10] and without a diagnostic coarse fraction, it is very difficult to suggest an area of production. Such Neogene clays are found within the vicinity of Thronos Kephala and there is no reason for most members of this fabric group to be non-local. Samples SY81, 74 and 71 are very similar to one another; the others have different coarseness and have microfossils in the fine fraction.

GROUP 6 Fine-grained fabric
26 samples

This fabric corresponds to the finer version of the locally manufactured pottery. It is characterised by a well fired orange micromass with a fine fraction composed of quartz, feldspar, biotite, serpentinite and opaques (Fig. 5c). When present, fine

[10] Hein, Day, Quinn, Kilikglou 2004.

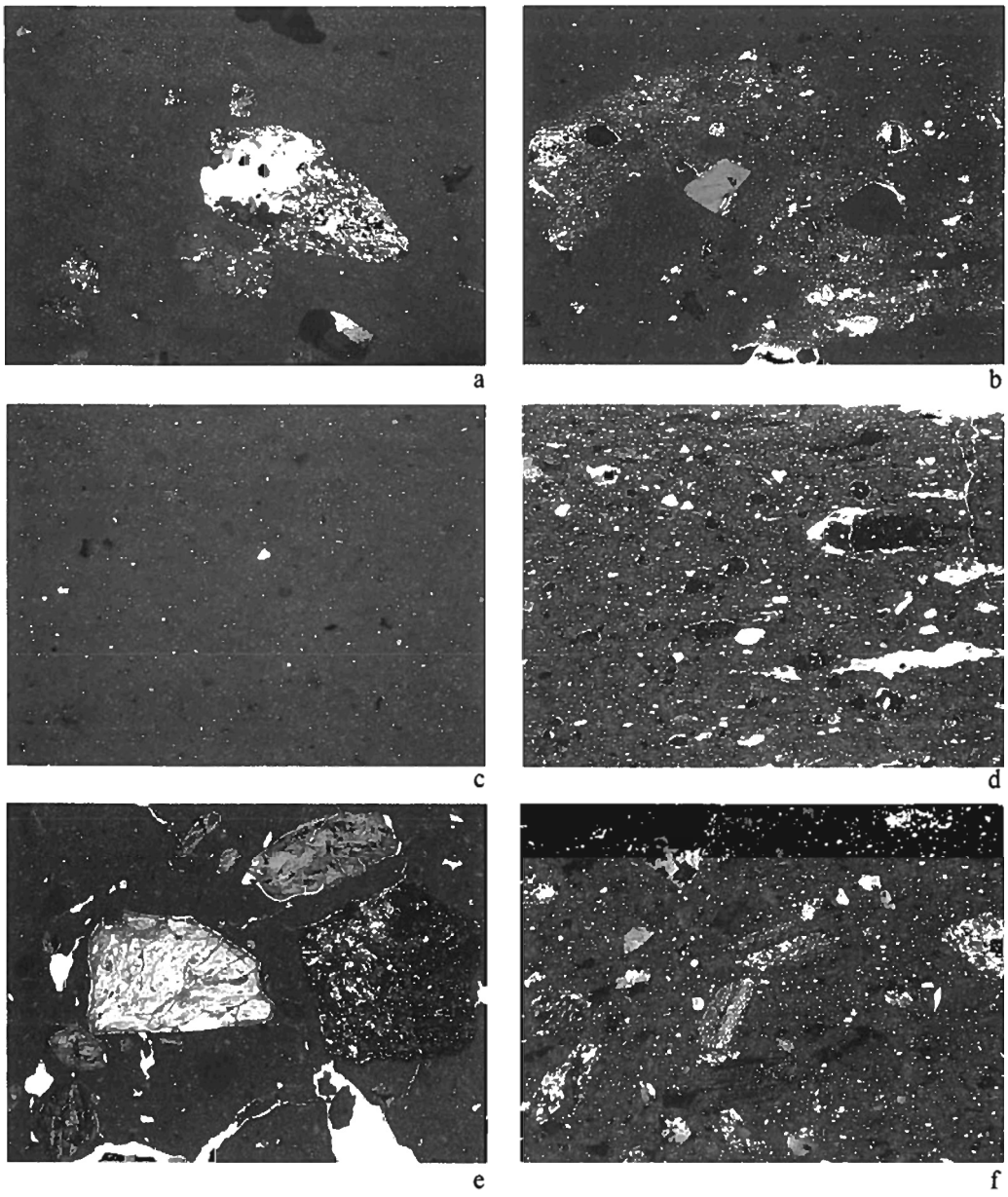

Fig. 5 – Thronos Kephala. a. Group 4, garnet schist (SY7, XPL, field of view 5.9 mm); b. Group 5, red TCFs in calcareous Neogene clay (SY74, XPL, field of view 7.4 mm); c. Group 6, fine-grained (SY10, XPL, field of view 3 mm); d. Group 7, black TCFs (SY118, PPL, field of view 3.7 mm); e. Loner SY60, serpentinite temper (PPL, field of view 5.9 mm); f. Loner SY99, quartzite rich (XPL, field of view 9 mm).

sand-sized inclusions consist of low-grade metamorphic rocks, calcimudstone and siltstone. Very few samples have a mottled or overfired micromass.

GROUP 7 Fine-grained fabric with black TCFs
6 samples

This minor fabric is characterised by dark grey-black TCFs, i.e. clay pellets, which are part of the clay mixture (Fig. 5d). Apart from the clay pellets, there are monocrystalline quartz, quartzite and calcimudstone along with rare mica and epidote minerals in the fine fraction. Such TCFs were not observed in the local manufacture of coarse, medium-coarse or cooking pot fabrics and it is believed that this fabric group is an extra-regional import to Thronos Kephala. Another diagnostic feature related to an imported provenance to Thronos Kephala is the macroscopic bluish grey colour of the fresh section. Fine fabrics with dark clay pellets characterise Early Iron Age pottery at Eleutherna[11] and are very similar to this fabric group.

PETROGRAPHIC LONERS

SY60

This coarse-grained fabric is characterised by coarse serpentinite temper added to a fine calcareous clay base (Fig. 5e). In addition to serpentinite, there are rare polycrystalline quartz, quartzite, phyllite, feldspar-quartz-hematite rock fragments, chert and mudstone. The presence of serpentinite as temper is unique at Thronos Kephala. Further investigation is needed to propose an area of production as serpentinite comes from the ophiolitic deposits, which outcrop elsewhere in Crete[12], including in the Aghios Vasileios valley.

SY99

Sample SY99 is another single-sample fabric which differs from the main local coarse-grained groups by its bright red micromass, high amount of quartzite, oxidised low-grade metamorphic fragments and very coarse sand-sized quartz inclusions (Fig. 5f). It resembles closely the clay collected south of Mount Vrysinas (SGS 26) as well as the Bronze Age fabrics of that area[13]. It is thus considered a regional but non-local production in the Thronos Kephala assemblage.

SY67

This coarse-grained fabric is characterised by a high fired calcareous clay base tempered with water worn sand of grey siltstone with black oxidised rims, mono-

[11] Nodarou 2008.
[12] Nodarou 2007.
[13] Kordatzaki 2007.

and polycrystalline quartz, feldspar, phyllite, quartzite, chert and very rare weathered inclusions of granite and basalt (Fig. 6a). The very fine mottled micromass and the presence of water worn grey siltstone inclusions suggest that this fabric group was not produced at Thronos Kephala and was possibly imported from the western Mesara.

SY110

This is a coarse fabric characterized by the presence of calcimudstone and mica schist and could be associated to *Group 3*. The low fired micromass has orange and buff-firing colours, attesting to poorly mixed calcareous and low-calcareous clays. Other inclusions are frequent low-grade metamorphic rock fragments, mainly phyllite and quartzite, and common to rare quartz, chert, feldspar, sandstone, mudstone and epidote-group minerals. The inclusions have a bimodal distribution.

SY113

This fabric is characterised by common calcimudstone (mainly depleted) and sedimentary rock fragments (mudstone and sandstone), along with few to rare low-grade metamorphics of the Phyllite-Quartzite series, quartz, weathered igneous rock fragments (basalt) and serpentinite. It is well fired as evidenced by its inactive micromass and depletion of calcareous inclusions. The mix of sedimentary and metamorphic rock fragments is unusual at Thronos Kephala but is commonly used during the Early Iron Age in north-central Crete, especially at Knossos[14]. Sample SY113 is thus believed to be an import from north-central Crete.

SY54

Sample 54 has a very coarse-grained fabric characterised by a mix of sedimentary and metamorphic rock fragments (Fig. 6b). The coarse inclusions, which have a bimodal distribution, consist of dominant sandstone and siltstone, common chert and monocrystalline quartz and very few to very rare quartzite, phyllite, shale and mudstone. As with SY113, the mineralogy is closer to fabrics from north-central Crete, i.e. Knossos[15], than the local or regional fabric groups.

SY29

This low fired coarse fabric is characterised, as the other local fabrics, by low-grade metamorphic rock fragments but differs by the presence of microfossils in the fine and coarse fractions. Microfossils have not been identified in the local fabrics but such fabrics have been identified in the Potamies valley[16] as well as in Knossos[17]. Apart from the microfossils, the inclusions are frequent quartzite and phyllite, common quartz and calcimudstone, and very rare chert and clinozoisite.

[14] Boileau, D'Agata, Whitley 2009.
[15] Boileau, D'Agata, Whitley 2009.
[16] Kordatzaki 2007.
[17] Quinn, Day 2007.

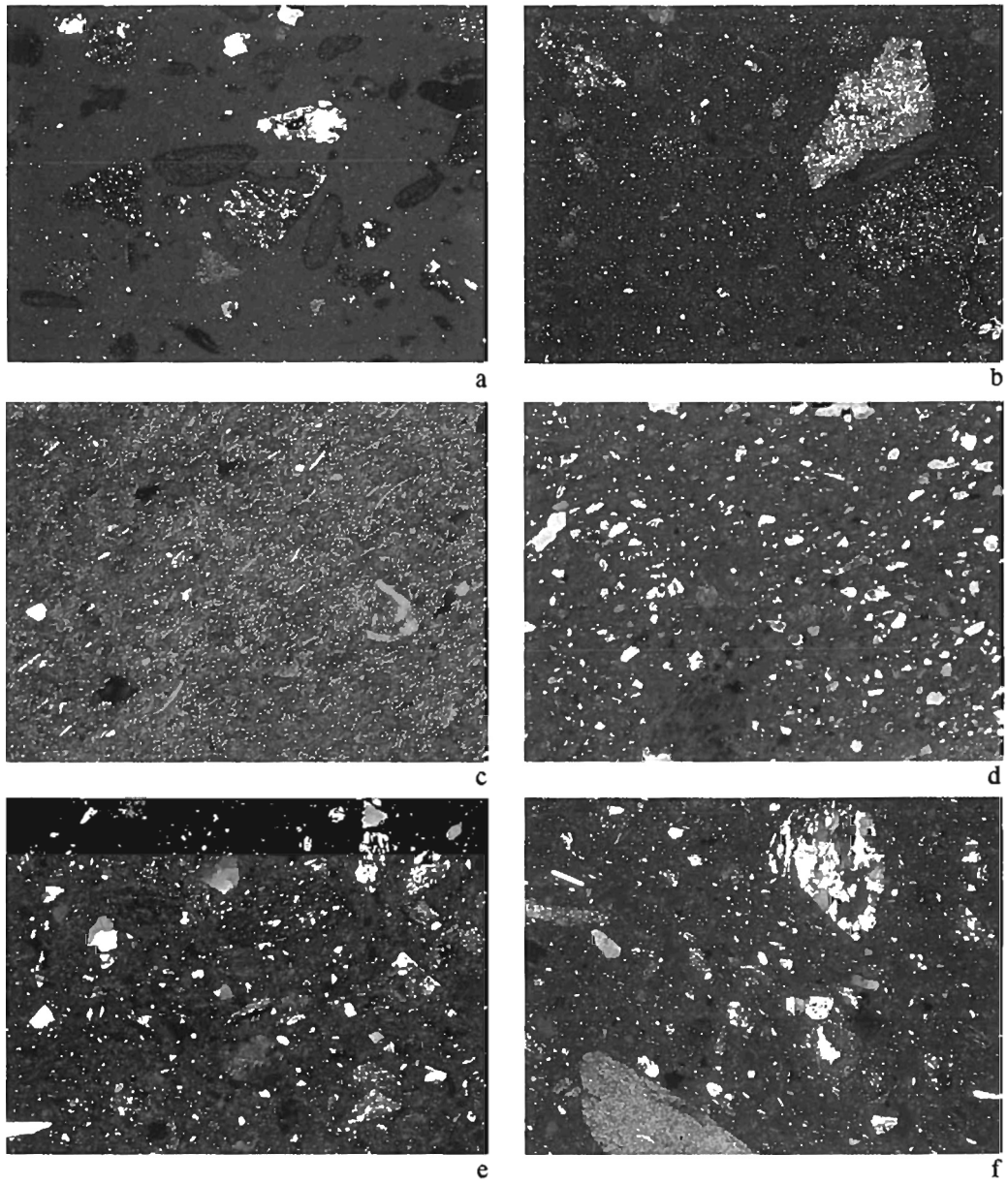

Fig. 6 – Thronos Kephala. a. Loner SY67, water worn phyllites (XPL, field of view 7.4 mm); b. Loner SY54, mix of sedimentary and metamorphic rock fragments (XPL, field of view 9 mm); c. Loner SY92, shell-rich (XPL, field of view 2.5 mm); d. Loner SY11, fine calcareous with sponge spicules (PPL, field of view 2.5 mm); e. Loner SY193, brown phyllite and biotite-rich (XPL, field of view 4.6 mm); f. Loner SY195, red micaceous and low-grade metamorphic (XPL, field of view 3.7 mm).

SY92

This fabric is unique in the Thronos Kephala assemblage and is characterised by fine shell-rich low fired clay paste (Fig. 6c). The very fine elongated shell fragments are strongly aligned parallel to the vessel's wall. Apart from the shells, there are monocrystalline quartz and micrite calcimudstone. Such fine calcareous shell-rich fabrics have been identified at Eleutherna but interpreted as non-local[18].

SY11, SY8

The fabric of SY11 is characterised by the rare presence of sponge spicules in a calcareous micromass (marine clay) (Fig. 6d). Apart from the microfossils, the coarse inclusions are mono and polycrystalline quartz, calcimudstone, feldspar, mica laths and serpentinite. It does not match any of the other fabric groups locally produced at the site. Very similar LM IIIC fabrics have been identified at Khamalevri[19] and it is likely that this pot was manufactured there and imported to Thronos Kephala. SY8 has a semi-fine calcareous fabric characterised by microfossils and burned out vegetal matter, as well as monocrystalline quartz, calcimudstone, chert, quartzite, polycrystalline quartz, serpentinite, mica laths and epidote-group minerals. It could also be an import from Khamalevri.

SY100

This fabric is very fine and characterised by a highly fired calcareous micromass with a mottled appearance, similar to the Knossian fine fabrics. Unfortunately the fabric is too fine grained to be diagnostic of an area of production. The very fine sand and silt-size inclusions of monocrystalline quartz, biotite and siltstone have an open-spaced distribution.

SY52, SY 68

These two samples exhibit very fine and overfired fabrics. Wasters are usually considered to represent locally produced pottery. The mineralogy of these samples is however undiagnostic, consisting of monocrystalline quartz, quartzite and sandstone.

SY193, SY199

The abundance of biotite laths in the fine and coarse fractions differentiates SY193 from the other fabrics and suggests an extra-regional or even off-island origin of production (Fig. 6e). This coarse-grained red-firing fabric is characterised by brown phyllite, yellow mica shimmer aggregates, mica-quartz schist, biotite laths and tabular grains, muscovite, yellow mica, mono- and polycrystalline quartz, chert, feldspar, clinozoisite, glaucophane, weathered igneous rock fragment, serpentinite and epidote-group minerals. The inclusions tend to have a bimodal distribution. The coarse-grained micaceous fabric of sample SY199 is closely similar to SY193 in terms of the mineralogy of the inclusions except for the presence of metaquartzite, chlorite schist and higher amount of chert.

[18] Nodarou forthcoming, 350.

[19] Moody, Robinson, Francis, Nixon, Wilson. 2003, 97; Nodarou forthcoming.

SY195

This fabric is characterised by a bright red slightly micaceous clay base with frequent feldspars in the coarse fraction (Fig. 6f). Otherwise, the inclusions are quartz, quartzite, quartz-chlorite schist, yellow phyllite, biotite/amphibole, feldspar-biotite rock fragments and mudstone. The characteristics of this fabric point to a Southern Crete or Pedhiada region origin of production.

4. Pottery productions circulating at Thronos Kephala (ancient Sybrita)

Local Productions

Groups 1, 2, 5 and *6* represent the local pottery productions at Thronos Kephala. These fabrics, made with locally available raw materials deriving from the Phyllite-Quartzite series and Neogene clays and marls, were used consistently throughout the occupation of the site for the production of different vessel types and sizes. Petrographic analysis has clearly shown that different clays and processing practices were used for different functional types of vessel. Furthermore, there are no clear chronological or contextual differences and overall the results attest to a good degree of continuity in the use of raw materials and ceramic technology. Nevertheless, minor changes in the main coarse-grained fabric were observed.

Group 1 shows a continuum in the increasing amount of calcimudstone content and optical activity of the micromass in the later periods, which results in a paler orange fabric. The fine fraction also becomes slightly more abundant. In the earlier periods, rock fragments are generally, but not systematically, coarser-grained and the micromass more highly fired, i.e. optically inactive. In terms of clay paste technology for the coarse wares, the strong bimodality of the grain-size distribution evidenced by a very fine micromass almost devoid of a fine fraction and the presence of large rock fragments in the coarse-fraction indicate that potters levigated and subsequently added sand temper to the clay base. The coarse-fine relationship of this fabric is highlighted by sample SY190a/b, which shows a coarse fabric used for the lower part of the vessel and a very fine fabric for the upper part of the same vessel. It also suggests that potters intentionally added phyllitic sand to a levigated clay paste preparation. The members of Subgroup 1b all share a fast-firing technology (i.e. light grey core) which could be attributed to changes in the organisation of pottery production, more specifically the firing procedures, or to the products of a different workshop using similar clay paste recipes and manufacturing the same vessel types. The pithoi fabric, Subgroup 1c, with its different clay paste and mineralogy (i.e. higher yellow phyllite content) could also reflect the production of another local workshop.

Group 1 features 82 closed vessels in coarse ware datable to between the 12th and the early 7th century BC: they are mostly amphorae – more rarely hydriae, such as the SY33 – and some fragments of pithoi. It also includes the fragment of an LM IIIC basin base SY170, a LG open vessel SY142, and two LG/EO pyxides SY141 and 142. SY1[20] (Fig. 7) belongs to an LM IIIC Early amphora decorated with a scroll, or

[20] THK54/16, from Pit 54: D'Agata 2003, 28, Fig. 2.1; 2007, 99, Fig. 21.1.

'S' motif, on the shoulder, a type found both in Crete and on the Greek mainland in this phase[21]. To the same type probably belong the two handles decorated with the 'S' motif from Pit 1, SY3 (Fig. 7) and 4[22]. SY166 and 167, from Building 1, relate to medium-to-large coarse stirrup jars attributable to LM IIIC-SM. Fragments of walls decorated with a high and wide wavy band, similar to SY166 (Figs. 7, 16), are present in the ceramic assemblages of Thronos Kephala in LM IIIC and SM[23]. SY167 (Fig. 7) is the stirrup from a stirrup jar, also in coarse ware, with a spiral painted on the top[24]. The fragment of a base SY177 (Fig. 7) relates to a jar or stirrup jar. SY170, the fragment of a base (Fig. 7), presumably comes from a cylindrical basin, with traces of a linear decoration both inside and outside.

SY43 (Fig. 8), from Pit 53, which constitutes a closed context of the EPG period, is a two-handled jar whose rim diameter is 28.5 cm. This is a plain type in coarse ware, with an ovoid body and flat base, familiar in central Crete in SM and PG funerary contexts, where it was generally used as a cinerary urn.[25] The specimen from Thronos Kephala attests to domestic use for this type. The two fragments of pithoi SY85 from Pit 29, and SY 91 from Pit 30 belong to advanced PG contexts. SY142 (Fig. 8) is a fragment of an open vessel, perhaps a crater decorated with a central rectilinear panel[26]: the presence of the meander, which appeared at Knossos in the MG and is believed to show Attic influence, suggests that this vase does not predate this phase. SY150 (Fig. 8) represents a closed vessel: the dark-ground body, the groups of reserved bands and the small decorative motifs in the panel could relate to a neck-handled amphora of MG-to-LG date[27]. SY140 and 141 (Fig. 8) are a LG/EO couple of very similar vases, two pyxides with sloping shoulder and straight-sided body: apart from the context of provenance, the decorative motifs, which include chains of 'S' and rows of tiny concentric circles, are indicative for the chronology of the two items.

The red fabric of *Group 2* occurs only in cooking pots, including braziers. It differs from the coarse-grained fabric by its red-firing clay base with higher quartzite content and abundant quartz-rich fine fraction. The close similarity of this fabric with the red iron-rich metamorphic clays sampled near the site is a good indication that potters deliberately selected naturally coarse iron-rich clays to manufacture pots intended for cooking activities. Moreover, the high amount of quartz in these clays would have been suitable for pots repeatedly submitted to thermal stress[28]. Chronologically, the 27 fragments of *Group 2* date from LM IIIC to LG/EO.

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[21] Cf. D'Agata 2003, 28; 2007, 99.

[22] Cf. D'Agata 2007, 99, Fig. 20,1.

[23] A fragment from Pit 20, was published in D'Agata 1999, 200 no. 20.11, Fig. 12. For discussion of the type, infra.

[24] Cf. for example Hallager 2000, 163, pl. 50, 71-P0736/0763/0779/77-P0719.

[25] Knossos, North Cemetery: Coldstream, Catling 1996, I, 58 and II, 304 no. 2.1, Fig. 80 (h. 33.5, rim diam. 27), SM; Coldstream 2001, 63, pl. 30c, from tomb 285.58 (h. 42.2, rim diam. 27), EPG; on the type see also Coldstream, Catling 1996, II, 311-12. Petrokephali, near Phaistos: Rocchetti 1967-1968, 198 no. 55, Fig. 32 (h. 34, diam. 25.4), EPG.

[26] For the type cf. Coldstream 2001, 46-51, Figs. 1.13c, 1.15c.

[27] For the type cf. Coldstream 2001, 23.

[28] Kilikoglou, Vekinis, Maniatis, Day 1998.

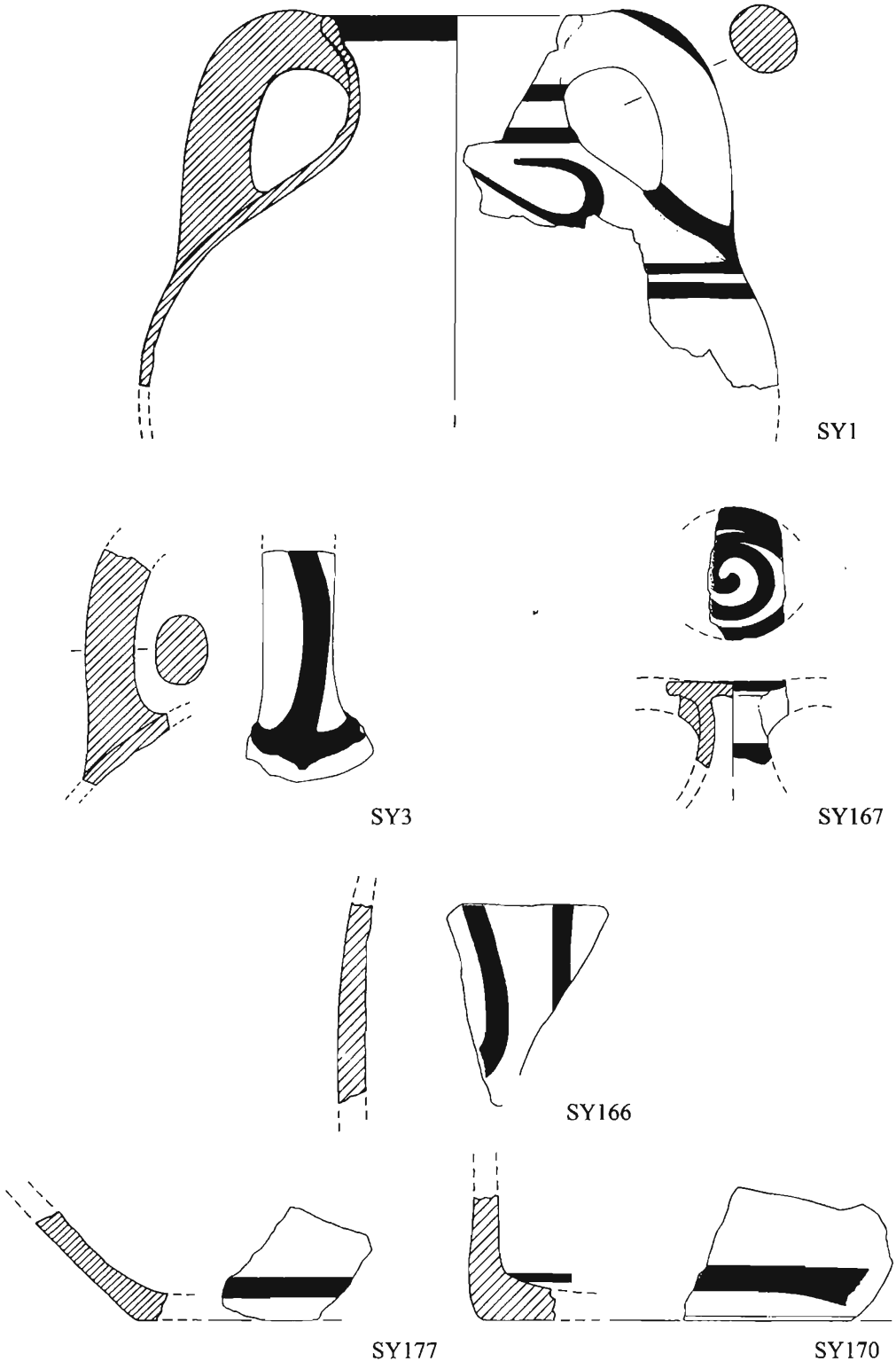


Fig. 7 – Thronos Kephala. Group 1 (scale 1:3).

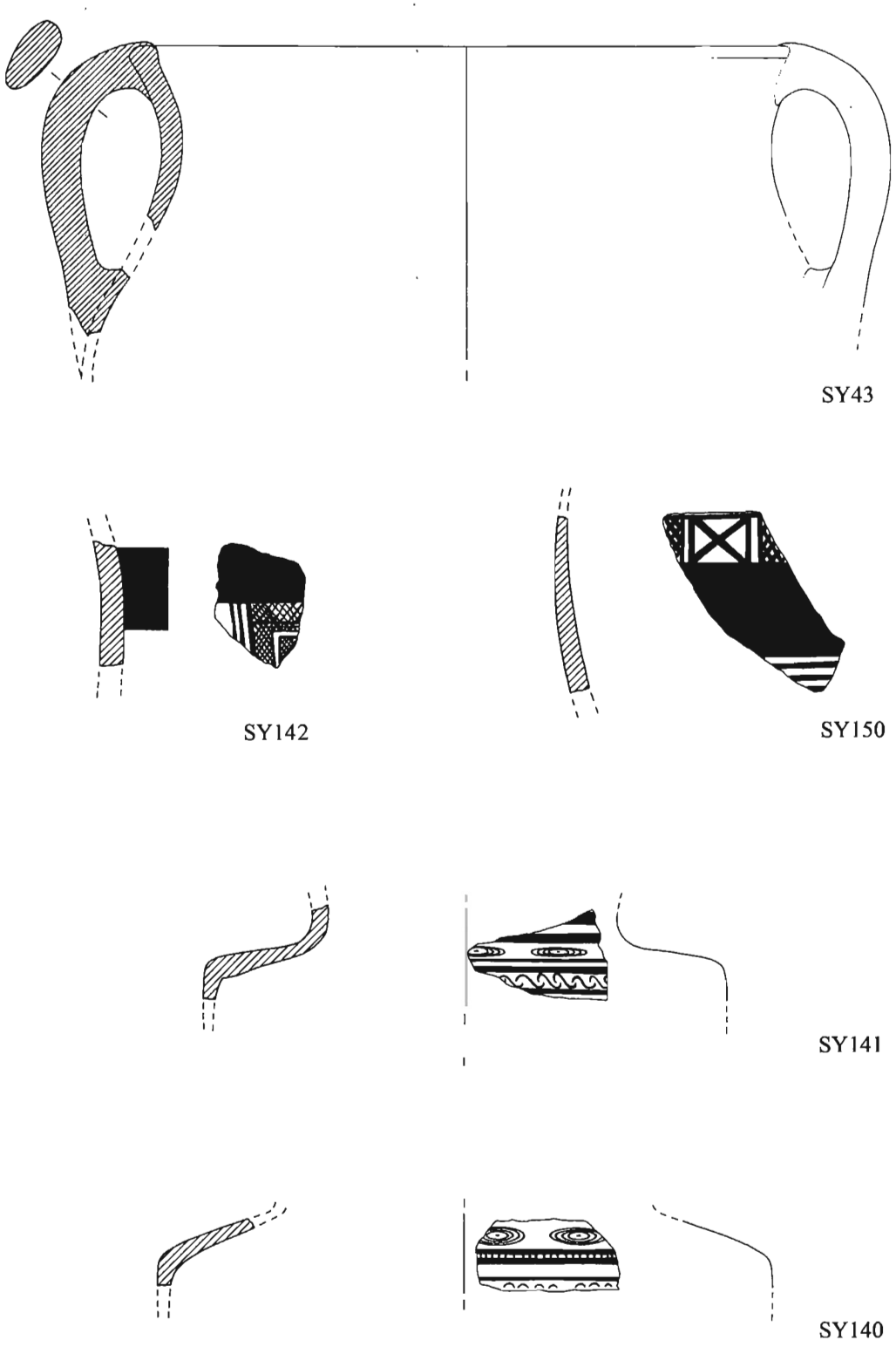


Fig. 8 – Thronos Kephala. Group 1 (scale 1:3).

They are predominantly cooking pots of the tripod type: as in the case of SY179 (Fig. 9), fragment of wall with horizontal handle, and SY178 (Fig. 9) the foot of a pot with vertical groove incised on the outer surface and circular cross-section. In LM IIIC and SM the tripod pots with horizontal handles are more common at Thronos Kephala than those with vertical handles[29]. In *Group 2* we also find SY172, a disc-shaped lid decorated with finger impressions along the edge (Fig. 9), a fairly common type at Thronos Kephala and in general on Crete in the 12th century BC[30], and the remains of an unusual jug, SY171 (Fig. 9), which can also be dated to the 12th century BC.

Two fine-grained fabrics, *Groups 5* and *6*, were used for small- and medium-sized vessels. They represent the fine-grained members of the local coarse-grained fabric groups. High-calcareous clays are often mixed with other clays to improve workability of clay paste[31] and this seems to be the case for *Group 6* which has a pale orange to pink refiring base clay. Moreover, streaks and ribbons of different colour and texture are present in the micromass, attesting to the mixing of clays. In contrast, the pots of fabric *Group 5* with a buff-firing colour and naturally occurring red TCFs were made with Neogene clays. This group is quite heterogeneous. The near absence of a coarse fraction indicates that potters levigated the clays to extract the sand-size inclusions. It also means that without a diagnostic coarse fraction, petrographic analysis and provenance assignation are challenging. However, there are no reasons for these two fabric groups to be non-local.

The 18 pieces attributed to *Group 5* can also be dated, overall, to between LM IIIC and LG/EO. The earliest include SY164 and the two-handled bowl SY175, both datable to LM IIIC. As for SY164 (Fig. 10), in view of its fragmentary nature it is not clear whether it was a plain bowl or a kylix: in any case it does not seem to belong to a type common at Thronos Kephala[32]. SY175 (Fig. 10) comes from a two-handled bowl, the most common type of fine pottery in the site in LMIIIC[33]. The decoration features multiple concentric semicircles, isolated and repeated. SY176 (Fig. 10) can be attributed to an amphora with 'S' motif similar to SY 1 in *Group 1*, as also probably the base SY12 (Fig. 10). Skyphos SY152 (Fig. 10) can be dated to the early PG: bell-shaped and dipped, it belongs to the most common type in fine ware occurring on the site in PG[34]. The same dating can be made for SY163 and SY158. SY163 derives from non-joining fragments of THK02/1, the figured crater from Thronos Kephala featuring dancing warriors[35]. The vase dates to the EPG. Fragment SY158 (Fig. 10), with concave neck and strap handles, corresponds to

[29] Thus the opposite situation to the one documented for example at Khania, Hallager 2000, 158.

[30] Cf. Khania: Hallager 2000, 163, pl. 47, 71-P 1312, 71-P 0937, and Khamalevri: Andreadaki-Vlazaki, Papadopoulou 2005, 388, Fig. 43.

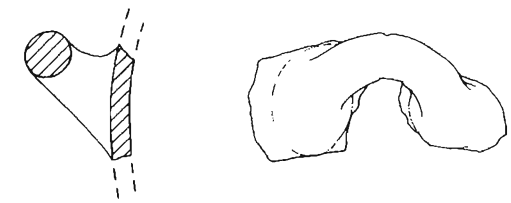
[31] Day 1995.

[32] For a vase with a similar profile from Thronos Kephala, D'Agata 2003, 29, Fig. 3.2.

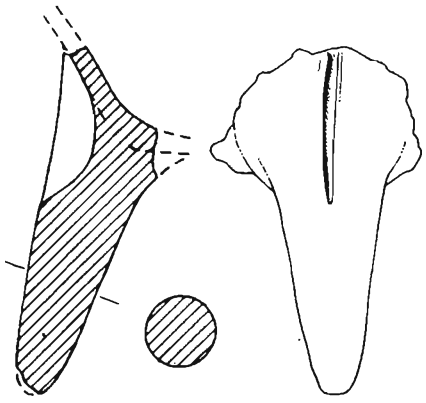
[33] This corresponds, in the typological classification of the pottery from the ritual pits, to Type 1.B, characterised among other things by a diameter of between 11 and 12 cm, and a reserved band near the rim inside, D'Agata forthcoming a.

[34] Cf. for example at Thronos Kephala, skyphos 10/17 from Pit 10, D'Agata 1999, 206.

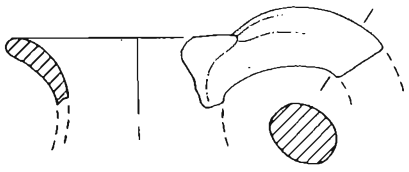
[35] D'Agata, Karamaliki 2002; D'Agata 2006, 405; D'Agata 2008a, 221; D'Agata forthcoming b.



SY179



SY178



SY171

SY172

Fig. 9. Thronos Kephala. Group 2 (scale 1:3).

the neck-handled type of amphora known at Knossos in this phase where it is considered as of Attic derivation[36]. We can note in this specimen the presence of the reserved neck, usually attested in later examples, but already known in EPG[37]. Finally, SY94 (Fig. 10)[38] is a fragment of wall decorated with a vertical chain of solid lozenges, which could be related to a continental, i.e. Attic, type of crater, decorated with a central rectilinear panel[39].

Group 6 comprises 26 pieces including numerous types, once again dating from LM IIIC to LG/EO. The earliest include the crater base SY13 from Pit 36 (Fig. 11), distinguished by a zigzag frieze near the foot[40]. The same dating applies to the crater fragment SY169 (Fig. 11) decorated with a composite motif of spirals and small arches,[41] the foot of the dipped cup or bowl SY173 (Fig. 11)[42], and the closed vessel SY165 decorated with a wavy band (Fig. 11), probably from a medium-sized stirrup jar in fine ware[43]. Datable to EPG, although maintaining the SM stylistic tradition, are the bell-cup SY155 (Fig. 11)[44], and jug or oinochoe SY151 (Fig. 12), decorated on the shoulder with zigzag motifs[45]. The conical foot SY95 (Fig. 12)[46], from an advanced PG context, belongs to a bell-shaped skyphos dipped in paint from the foot, so that the interior and the upper two thirds of the exterior were coated, the lower body and the foot reserved. Also belonging to *Group 6* are skyphoi SY153 and 154 (Fig. 12), bell-shaped and dipped as SY152[47]. Both pieces date to the early PG. The two one-handled cups SY149 and SY139 (Fig. 12), from LG/EO contexts, show similar profiles, with everted lip. For both we can hypothesise a flat base. SY149 is a dipped cup, SY139 is a monochrome, black cup with thin wall[48]. Finally, it is particularly significant to find as part of local production at

[36] Coldstream, Catling 1996, II, 332.

[37] Brock 1957, 21, Tomb XI.181, pl. X; Coldstream 1996, 233.

[38] Cf. D'Agata 1999, 210, Fig. 20.

[39] Coldstream, Catling 1996, II, 398 no. 7, Fig. 124 (LPG, from Tomb 207); Coldstream 2001, 47 no. 28, Fig. 1.15c (MPG, from Tomb 175).

[40] A useful comparison for the vase profile is the figured crater of Mouliana (reproduced in D'Agata 2007, Fig. 13.1) which is also characterised, not unlike the zigzag frieze on the crater from Thronos Kephala, by a wavy band between lines on the lower wall. Both vases can be dated to LM IIIC Late, cf. the sequence of Cretan LM IIIC-SM deposits given in D'Agata 2007, 101, table 3.

[41] The decoration of this vase must have featured a complex syntax, also known on Crete as 'Pleonastic Style', based on wide bands bordered by lines, ending in spirals and joined up by concentric arches. This syntax recurs on a common family of IIIC craters in Crete, of the type with carinated semi-globular body and distinct rim, cf. for example, specimens from Khania: Hallager 2000, 146, 71P 0735, pl. 39; Knossos: Warren 2007, 341, P1924, and Thronos Kephala: THK07/666, unpublished.

[42] 'Blob' cups or bowls are present but not common at Thronos Kephala in LM IIIC and SM: cf. a deep bowl from Pit 20, D'Agata 1999, 200 no. 20.2, Fig 11. As for Khania, Hallager 2000, 137, 141.

[43] Cf. a similar vase from Khalasmenos, Tsipopoulos 2004, 108, Fig. 8.5, 92-9.

[44] Cf. a vase of the same type from Pit 10, D'Agata 1999, 208, Fig. 18. For this type see in general Coldstream 2001, 55, Fig. 1.19e.

[45] Cf. the type documented in Tomb IV at Fortetsa, which corresponds to our vase in form and decoration: Brock 1957, 24 no. 211, pl. 15; see also Boardman 1960, 133, Tomb V.7, pl. 35, Fig. 4.

[46] D'Agata 1999, 209, Fig. 20.

[47] However since both samples are chemical outliers, the origin of their manufacture remains uncertain, cf. Boileau, Kilikoglou, D'Agata, Whitley in preparation.

[48] Cf. Coldstream 2001, 55-56, Fig. 1.19l-m.

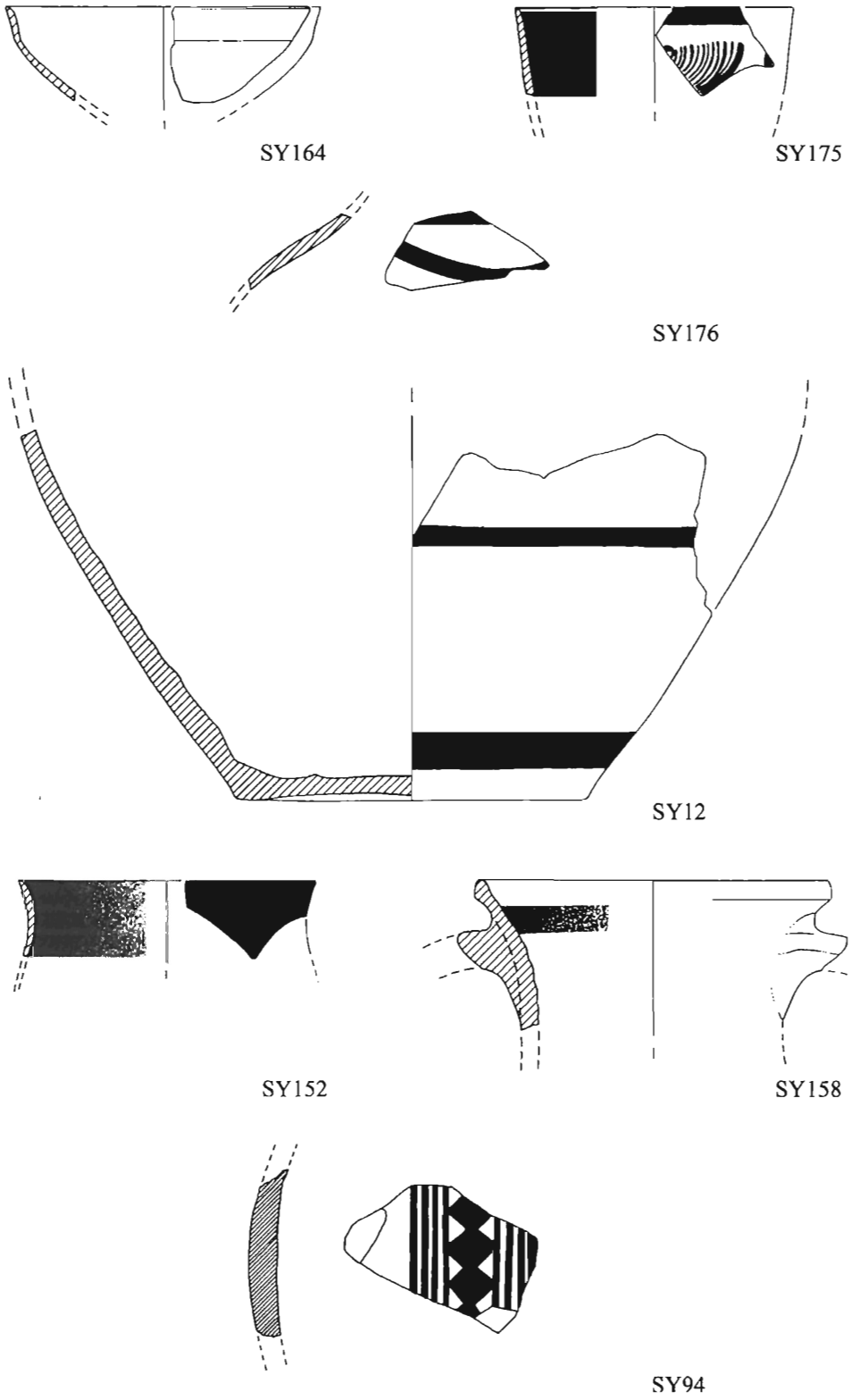


Fig. 10 – Thronos Kephala. Group 5 (scale 1:3).

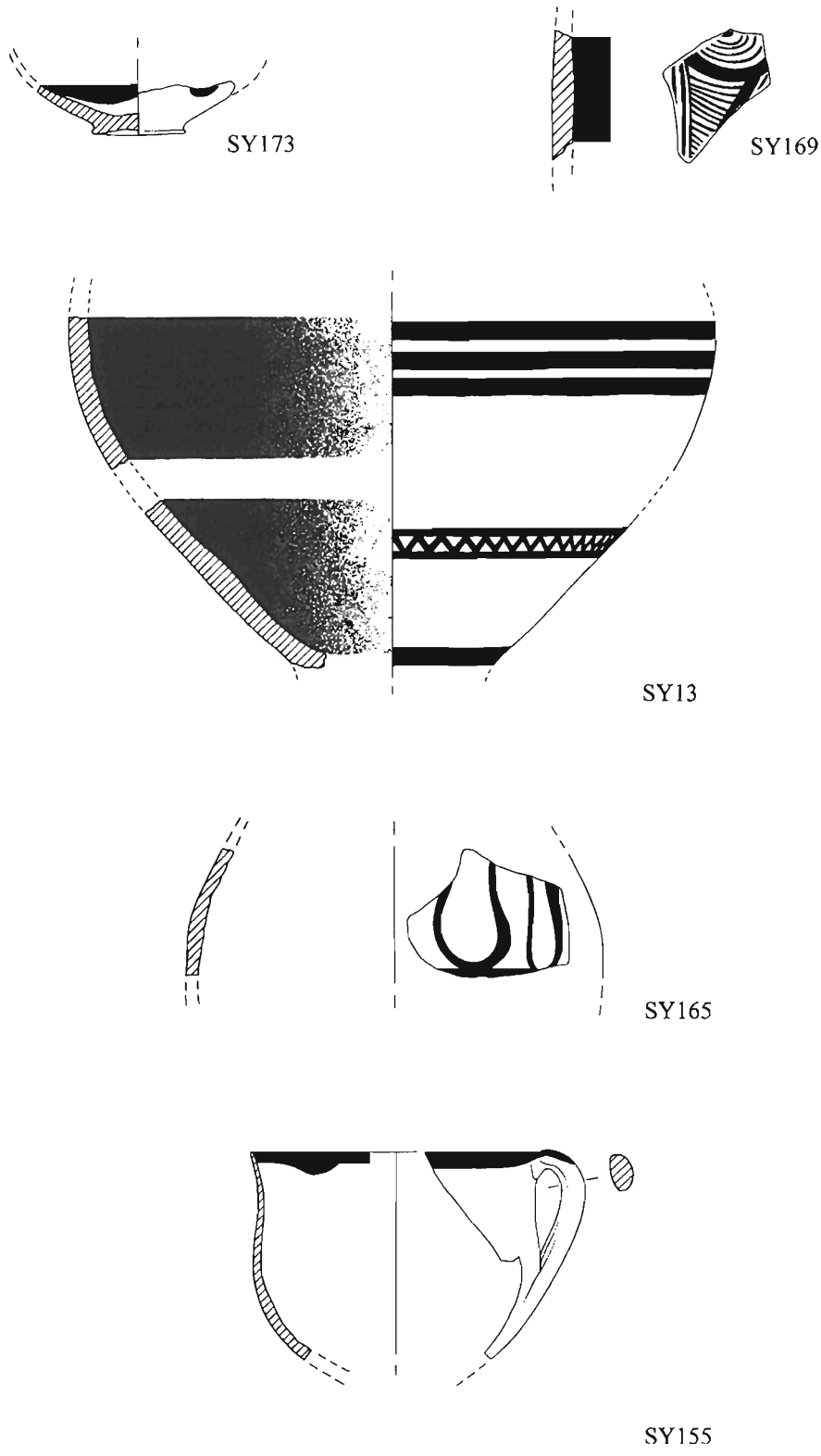
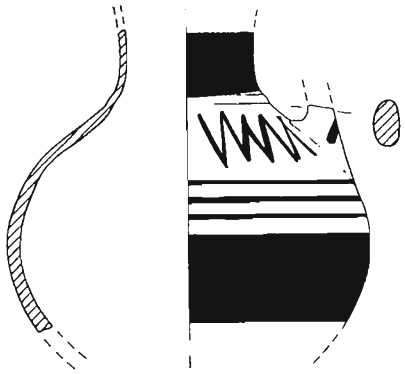
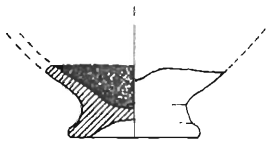


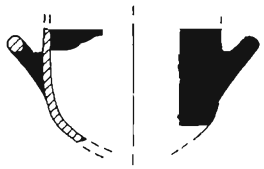
Fig. 11 – Thronos Kephala. Group 6 (scale 1:3).



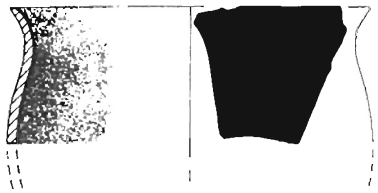
SY151



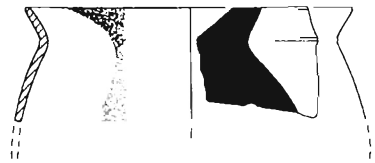
SY95



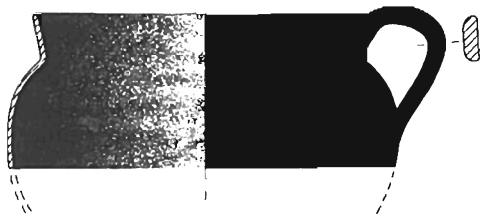
SY154



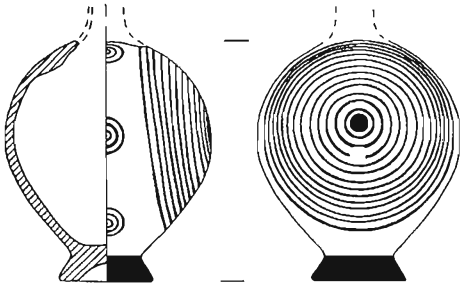
SY153



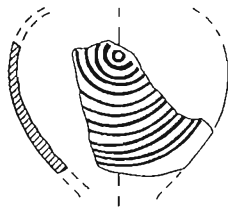
SY149



SY139



SY143



SY200

Fig. 12 – Thronos Kephala. Group 6 (scale 1:3).

Thronos Kephala the two Cretan-Cypriot lekythoi SY143 and 200 (Fig. 12), on a high foot and decorated with concentric circles. They confirm the existence on Crete of various workshops producing these vases[49].

Intra-regional productions

The relatively high occurrence of non-local fabrics at Thronos Kephala prompted us to reflect on what have to be considered 'imports', i.e. vessels exchanged over (long) distances, as opposed to vessels produced by workshops active elsewhere within the Potamies-Amari region. In the absence of data from regional surveys or systematic analysis of ceramic material from comparable sites, we have decided that the fabrics which are very similar to those produced at Thronos Kephala but whose mineralogy of the non-plastic inclusions derives from different raw material sources would be considered intra-regional products.

Groups 3 and *4*, together with loners SY60, SY99 and SY110, are thus considered intra-regional fabrics occurring at Thronos Kephala. They represent 14 per cent of the petrographic samples and appear since the foundation of the site in LM IIIC Early. The members of *Groups 3* and *4*, along with sample SY110, are characterised by non-plastic inclusions deriving from an ophiolitic schist source. Apart from the mineralogy of the coarse inclusions, the texture, colour and micromass are very similar to *Group 1*, the local coarse-grained fabric, making the microscopic distinction not always straightforward when only traces of ophiolitic related inclusions are present. This also raises the question of correctly identifying the fine end members of this fabric in the absence of a coarse fraction. The light grey cores, different clay pastes for pithoi (Subgroup 3b), closed vessels (Subgroup 3a) and cooking pots (SY16), attest to a shared potting tradition with the potters of Thronos Kephala. Moreover, the heterogeneity of the fabric points to more than one workshop production.

Group 3 includes 17 pieces in fine or semi-fine ware which date from between LM IIIC Early and LG/EO. SY2 belongs to the medium-sized hydria 54/1, from Pit 54 (Fig. 13)[50]. SY5, 6 and 7, dating from LM IIIC Early, are, respectively, fragments of an amphora, a crater and a deep bowl from Pit 3. The three vases could come from a banqueting set imported to the site as such at the beginning of the 12th century BC. SY16 is the foot of a tripod cooking pot from Pit 20, which was filled-in by LM IIIC Late. SY168 (Fig. 13), from Building 1, is an LM IIIC painted, shallow two-handled bowl, in coarse ware, with rounded bowl and banding in the interior. It is the Cretan version of the shallow angular bowl FS 295, in the variant with rounded bowl[51], and constitutes yet another demonstration of the parallel evolution on Crete and on the Greek mainland of the ceramic repertory of the 12th to 9th century BC. This type is characterised by profile, dimensions[52] and banding of the

[49] On this type cf. Brock 1957, 158 class E (iii); Coldstream 1984, 135-6; Coldstream, Catling 1996, II, 354-55; Coldstream 2001, 42. On Cretan production of Creto-Cypriot lekythoi found at Eleutherna, Nodarou 2008.

[50] On this vase and the type's evolution, D'Agata 2003, 26-27, Fig. 2.2.

[51] Cf. Mountjoy 1999, 159 nos. 321-22, Fig. 41, of LH IIIC Early date, from the Argolid.

[52] Diameter at top 22 cm.

interior[53], and does not appear to have been particularly common at Thronos Kephala. Finally *Group 3* also includes some fragments, dating from PG to LG/EO, of closed vessels (amphorae or hydriai, SY47 and 49, from Pit 53; SY79 from Pit 29), pithoi (SY40 from Pit 17; SY87 from Pit 30; SY108 from Building A1; SY126 from Building B1) and cooking pots (SY98 from Pit 30).

Group 4 includes 8 closed vessels (amphorae, above all, and pithoi) dating from between LM IIIC and LG/EO. SY7, from Pit 3, may be part of an early LM IIIC jug (?), plain and decorated with knobs. This type is known at Thronos Kephala but the fragmentary state of this specimen does not allow us to attempt an accurate reconstruction[54]. SY14 and 20 are two fragments of closed vessels, from Pit 20, datable to LM IIIC Late. The group also includes a fragment of pithos SM-EPG (SY156), and some fragments of closed vessels from PG to LG/EO (SY189, 115, 119).

Sample SY60, from an amphora found in an EPG context, has a buff serpentinite-rich fabric and must also come from a workshop located near an ophiolitic source, perhaps west of Thronos Kephala near the modern town of Spili where such raw materials outcrop. The high amount of serpentinite makes this single-sample fabric very different from *Groups 3* and *4* and could suggest the activities of yet another workshop exploiting similar raw material sources. With its mica schist inclusions, SY110, from a closed vessel, perhaps an amphora, found in a LG/EO context, could be associated to fabric *Group 3*. In the case of sample SY99, belonging to a storage vessel (Fig. 13) made in a red quartzite-rich fabric, the area of production is located north, near Mount Vrysinas where comparable fabrics have been identified. The fragment shows an applied band decorated with an incised zigzag pattern which is typical, at Thronos Kephala, of the PG period.

Extra-regional Imports

Imports from outside the Potamies-Amari valley have also been identified in the assemblage of the site. The most numerous is *Group 7* with its distinctive black TCFs that matches the local fabric of Eleutherna[55]. The fabric was used for small-sized vessels, mostly monochrome cups, dating to the Geometric period, with one exception that goes back to the advanced PG. Another sample, petrographic loner SY92 – 30/21, from Pit 30, the wall of a closed vessel with horizontal handle – is associated to the Eleutherna group as its fine-grained, shell-rich fabric was also identified in the assemblage of that site[56]. The vase should be dated to PG advanced.

[53] Documented also at Khamalevri: Andreadaki-Vlazaki, Papadopoulou 2007, 34, Fig. 8.5.

[54] At Thronos Kephala at least two different types of closed vessels decorated with knobs are known. 3/25, from Pit 3, is part of a plain jug with rows of knobs on the shoulder dating from LM IIIC (cf. Seiradaki 1960, 14, Figs. 8.5, 9.11, pl. 5). 5/17, from Pit 5, belongs to a painted closed vessel decorated on the shoulder with at least one knob; for similar, LM IIIB vases, see a LM IIIB fine hydria from Mameloukou (Godart, Tzedakis 1992, 47-48, pl. XL.3 on the right), and a jug from Voliones (Pologiorgi 1981, 99, Fig. 11).

[55] On ancient Eleutherna, Stampolidis 1996; 2004.

[56] A comparable fine fabric with shell fragments was identified at Eleutherna and was interpreted as an off-island import (Nodarou 2008, 353). Interestingly, the geochemical composition of SY92 is close to the Eleutherna Fabric Group 7. This NAA result suggests a common area of production for the

Other *extra-regional imports* are only represented by single-sample fabrics. Samples SY11 and SY8, both from Pit 3, are believed to come from Khamalevri, where similar fabrics have been identified. SY11 is the rim of deep bowl 3/6 (Fig. 14)[57], SY8 is the wall of a painted crater. The two fragments belong to LM IIIC Early.

From north-central Crete, in an area of production which could be close to Knossos, we have samples SY113, 54 and 29. SY 54 and 29 belong to cooking pots found in an LM IIIC Late context, the former, in a SM I context, the latter. SY113, from a pithos sherd, comes from a LG/EO context. Crater SY100[58] (Fig. 14), which dates to an advanced phase of PG[59], is an import from the Knossos area.

As for sample SY67 (Figs. 14 and 16), the fabric is closer to those of the western Mesara. It seems to be part of a storage jar of LM IIIC date, decorated with a frieze of spirals on the shoulder and, on the lower part, a large wavy band. The decorative pattern is very similar to the one used on a LM IIIC stirrup jar from Khania, whose provenance has been established as Knossian[60].

A non-regional origin of production has been evidenced for SY193, 199 and 195. The fabric of SY195 points to a south Cretan/Pedhiada origin of production. In the case of SY193 and 199, while they could be Cretan, there is also the possibility of a Cycladic origin. All of the three belong to cooking pots coming from the same PG context.

5. Pottery production and consumption at Thronos Kephala (ancient Sybrita): some preliminary conclusions

The petrographic investigation carried out on the ceramic materials from the settlement on the top of the Kephala aimed primarily at identifying the principal local productions – the ones which exploited sources of potting raw material close to the hill – from the 12th through to the early 7th century BC, when the settlement was destroyed and possibly temporarily abandoned. These productions have been classified in *Groups 1* (coarse ware and pithoi), *2* (cooking pots), *5* (semi-fine ware), *6* (fine ware). The multitude of shapes manufactured in rather consistent clay recipes, and the standardization of the production are indicative of a production level which is well above the household production, and of pottery workshops installed in the area exploiting the local resources. Since the settlement on the Kephala was founded at the beginning of the 12th century, it is not clear whether workshops were already active in the area at this time[61], or whether at least some were started up, as

black TCFs and shell-rich fabrics, but the petrography points to different raw material sources, cf. Boileau, Kilikoglou, D'Agata, Whitley in preparation.

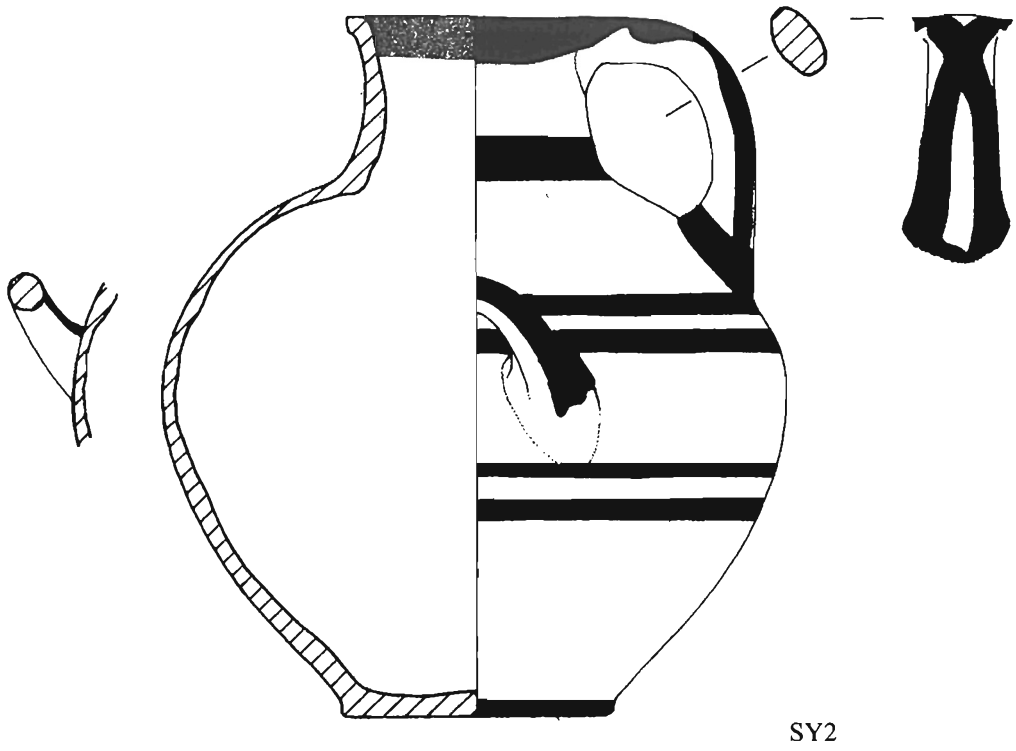
[57] For a similar decorative system at Thronos Kephala, cf. for example, D'Agata 1999, 194 no. 5.34, Fig. 7. For type and decoration, cf. a vase from Khamalevri, Andreadaki-Vlazaki, Papadopoulou 2005, Fig. 35. 94/10/5.

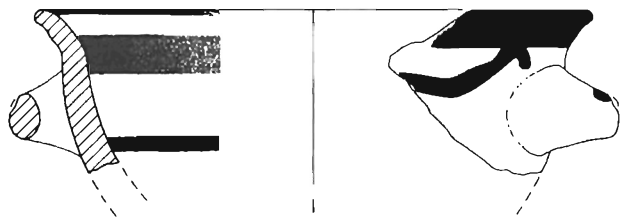
[58] D'Agata 2001, 330, Figs. 3-4.

[59] Coldstream 2001, 53, Fig. 1.17a. For decoration, Coldstream 2001, 54.

[60] Cf. Hallager 2001, 163-64 no. 71-P0736/0763/0779/77-P0719, pls. 50 and 59f.

[61] For the frequentation of this area in LM III and during the Dark Ages, Kanta 1994; Gavrilaki 1994; D'Agata 1999; Nowicki 2000, 194-209.





a

b

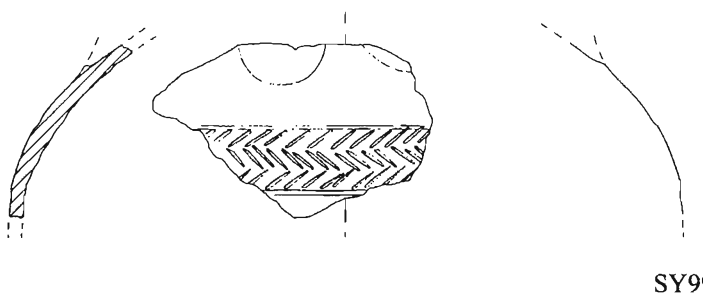
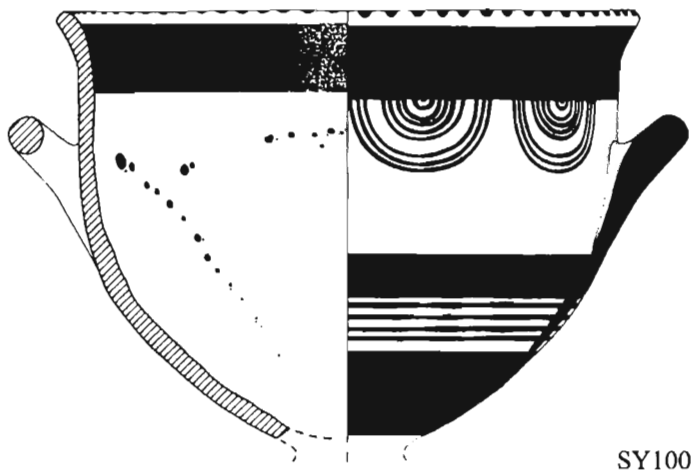


Fig. 13 – Thronos Kephala. a. Group 3; b. Loner SY99 (scale 1:3).

SY11

SY67



SY100

Fig. 14 – Thronos Kephala. Imports (scale 1:3).

it seems probable, at the time of the centre's foundation. Amphorae with 'S' motif on the shoulder were made using different clay pastes (*Group 1* and *5*), indicating the existence, in the 12th and 11th century BC, of at least two groups of local potters which supplied the site[62]. The same can probably be said for the PG craters which were produced in different clay fabrics (*Group 1* and *5*).

Groups 3 and *4* include ceramic materials produced with clays (raw material resources) found outside the area immediately around the hill. The relatively high quantity on the site of materials belonging to these fabric groups suggests that the centres of production were located within the intra-regional context of Kephala. In this sense, the region of Thronos Kephala corresponds to the hilly district bounded on the north-west by Mount Vrysinas[63], to the north and east by the foothills of Psiloritis[64], on the south-west by Mount Kedros (Fig. 15)[65]. These are the natural confines of the geographical district of the site of Thronos Kephala. The region, in addition to the Kephala, comprises Mount Veni with the site of Pandanassa[66] and the sanctuary at Patsos[67], the northernmost stretch, at least, of the Amari valley[68], the area immediately to the west of the Kephala, delimited by the valley of Aghios Vasileios[69], and the area immediately to the north and north-west (Potamies) of the Kephala, as far as Mount Vrysinas (Fig. 15). Thus it is quite likely, although still to be verified, that the materials in *Groups 3-4*, like some of the petrographic loners identified, come from sites within this geographical district[70].

With respect to LM IIIC and SM ritual pits, of the four specimens sampled from Pit 54, three are local and one, SY2, comes from the intra-regional context (*Group 3*). The provenance of sample materials from Pit 3 is more heterogeneous. Only a fragment of a two-handled bowl, SY9, proved to be local. The fragments of a crater and two-handled bowl, respectively SY8 and SY11, were imported from Khamalevri, on the north-western coastal strip, immediately to the east of the modern city of Rethymnon, whereas no less than 4 of the 7 specimens come from the intra-

[62] For identification of different ceramic traditions in the production of LM IIIC cooking dishes at Kavousi Kastro, Mook 1999.

[63] LM IIIC-SM pottery fragments collected on Mount Vrysinas are stylistically very similar to those from Thronos Kephala, and the same goes for the LM IIIC vases from the settlement of Aghia Irini, excavated by N. Karamaliki on the northern slopes of the same mountain. We take the opportunity to thank Georgia Kordatzaki and Nota Karamaliki for providing us with information about this area.

[64] In general, Andreadaki-Vlazaki 2004; Gavrilaki, Tzifopoulos 2006.

[65] For the site of Orne Kastellos, Nowicki 2000, 200; Kanta, Stampolidis 2001; on the site of Aghios Ioannis, at the southern end of the Amari valley, Godart 2001, 466.

[66] Cf. Tegou 2001.

[67] On the rural shrine in the gorge of Aghios Antonios (Patsos), where the cult was performed under a rock shelter, see Kourou, Karetsou 1994, and the important result of the excavations conducted in recent years by ΚΕ' Εφορεία Προϊστορικών και Κλασικών Αρχαιοτήτων, Khania: see Niniou-Kindeli 1989-1991; 1992-1994;1998-2000.

[68] A frequentation dating to LM IIIC and later is documented in this area.

[69] On LM IIIC and later occupation in the valley cf. Nowicki 2000, 201-06; Agelarakis, Kanta, Moody 2004.

[70] For examination of pottery production and consumption in a regional/intra-regional context, Day 1997; Nodarou 2007.

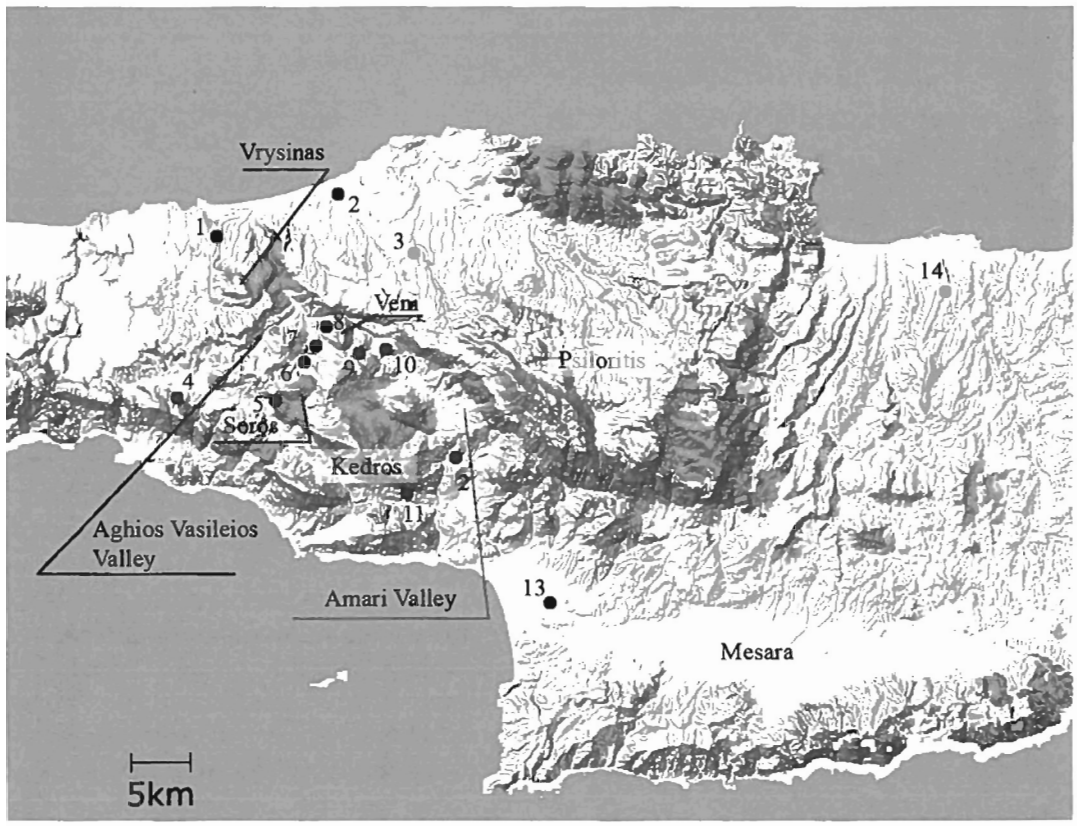


Fig. 15 – 1 Aghia Irini; 2 Khamalevri; 3 Eleutherna; 4 Atsipadhes; 5 Spili; 6 Patsos; 7 Pandanassa; 8 Voliones; 9 Apostoli; 10 Thronos Kephala; 11 Orne; 12 Aghios Ioannis; 13 Phaestos; 14 Konossos.

regional context (SY5, 6, 7, 9: *Groups 3-4*). Of the 7 specimens from Pit 20 at least two amphorae and one tripod cooking pot can be attributed to the intra-regional context (SY14, 16, 20). One cooking pot from Pit 36 (SY54) and one from Pit 41 were imported from north-central Crete. With respect to the Protogeometric period, a fragment of pithos from Pit 17 (SY40), two closed vessels from Pit 53 (SY47, 49), two closed vessels from Pit 29 (SY79, 84), and one cooking pot from Pit 30 are all of intra-regional provenance. If, as we have said, the existence of local ceramic productions available to the people who frequented the Kephala from LM IIIC Early can be taken for granted, the pottery that circulated on the Kephala in the 12th and 11th century BC also included intra-regional material and material imported from the north-western coast, north-central area of the island and Mesara[71].

[71] On the circulation of goods and/or individuals in the 12th century BC in the north-western area of the island cf. the ceramic imports from the Mesara identified at Khamalevri, Nodarou forthcoming. According to B. Hallager, in LM IIIC Khania "the ceramic evidence for contacts with other areas in Crete is scanty, and the few identified contacts are restricted to the areas of Knossos and Palaikastro", Hallager 2000, 173.

Since sampling of the ceramic material from the ritual pits was only limited and not systematic, for the moment we cannot say more. Within ritual contexts the high percentage of non-local materials could also be due to a special circumstance. We can note however that the 16 LM IIIC samples from Building 1, that is the structure designed to serve the events associated with the creation of the pits, were produced locally, with the exception of SY168 which comes from the intra-regional context. In noting this we do not mean, of course, to exclude the presence of imported materials from Building 1[72], but the possibility that a high percentage of non-local materials is concentrated in the pits could reflect deliberate behaviour aimed at highlighting the composite provenance of groups of banqueters, for whom the event associated with the banquet and the filling up of a pit had an important symbolic value in terms of visibility and social identity[73]. Finally we should mention that SY92 from Pit 30 – one of the latest, dating from advanced PG – comes from the Eleutherna area.

The variety of fabrics, local and otherwise, to be found among the ceramic material of Thronos Kephala for the whole period under consideration also prompts reflections on the role played by that centre in the island's regional trade dynamics. No certain off-island importation has been firmly ascertained, which is in fact hardly surprising given the inland position of the centre. Of 200 samples examined, in comparison with the 78 percent of local material we have 14 percent of intra-regional imports and 8 percent of extra-regional imports. There can be little doubt that one of the main reasons for the outward projection observed at the site after its foundation lies in the special position occupied by the hill of Kephala which, situated as we have said at the northern end of the valley of Amari, stands at a natural crossroads upon which converge valleys and landscapes from various parts of the island: to the south west, the route along the northern slopes of the Samitos and the Soros as far as the valley of Aghios Vasileios; to the north-east, the route that followed the low north-western foothills of the Psiloritis to lead into the small plain of Arkadi immediately south of the hills of Eleutherna, and from here to the coastal plain of Rethymnon; to the south, the valley of Amari, which led straight to the western end of the plain of Mesara (Fig.15)[74].

With regard to local production, the most interesting set of material in terms of circulation and trade consists of the stirrup jars decorated with high wavy bands. As is well known, stirrup jars in coarse ware are a typical Late Bronze Age Cretan product, presumably meant to contain olive oil and wine. In the 13th century BC transport stirrup jars, and especially those inscribed with Linear B signs, are among the best indicators for reconstructing organization of production and administration, and for understanding trade at local, micro-regional, i.e. within Crete, and macro-regional, i.e. within the Aegean and the Mediterranean, level[75].

[72] From here come, at least, fragments of a decorated stirrup jar probably imported from eastern Crete (region of Palaikastro).

[73] On the phenomenon of the ritual pits at Thronos Kephala, D'Agata 1997-2000.

[74] From Thronos Kephala, the western Mesara can be reached on foot in about 12 hours, and the valley of Aghios Vasileios, to the west, in less than 7 hours: cf. Pendlebury 1939, 13, who traversed the island on foot in the 1920s.

[75] Catling and Karageorghis 1960; Haskell 1981; Day 1988; Day, Haskell 1995; Day 1999; Haskell 2004; Day, Joyner 2005; Haskell 2005; Nodarou 2007; Day, Quinn, Kilikoglou, Rutter forthcoming.

On Crete, consumption of these vases has been ascertained to have continued in the 12th century BC. In this period large, coarse stirrup jars are found in many Cretan sites without however being among the most popular ware[76]. Concerning the decoration, we now see the definitive transformation of the octopus and its tentacles – which seems to have been a central Cretan LM IIIB feature – into a large and wide wavy band, painted on the body[77]. It is worth recalling that coarse stirrup jars decorated with wavy band and imported from central Crete, are to be found at Tiryns in IIIC Early contexts: in fact, they show that in the 12th century a flow of central Cretan stirrup jars was still arriving at the important site of Tiryns[78], attesting to the vitality of the off-island trade circuits in the aftermath of the fall of the Mycenaean palaces.

Although known to us only through fragments, coarse stirrup jars decorated with high and wide wavy band on the body constitute a recurrent type of ware in the Thronos Kephala settlement, attested mainly in contexts of the 12th and 11th century BC. In *Group 1* there are two fragments of coarse ware stirrup jars (SY166, 167) which can thus be attributed to local production. A further important consideration can be added: of 22 fragments of similar vases from the site that have been observed macroscopically with the aid of a 10x hand lens[79], 18 proved local: belonging, that is, to the class of fabrics identified with petrographic analysis. Of these, THK08/77, THK05/602, 20/11 are shown in Fig. 16. On the contrary, four fragments, attributable to at least three vases, were found to have been imported, and are probably to be attributed to two different workshops, quite likely in central Crete. THK04/72, shown here in Fig. 16, is probably an import from western Mesara which can be set alongside SY67 (Figs. 14 and 16) belonging to a stirrup jar which was also imported from western Mesara.

Hence, the evidence offered by Thronos Kephala represents a significant indicator of the fact that some workshops of central Crete must have continued to produce coarse stirrup jars, now decorated with a wavy band, in the 12th century BC, and that they were joined by new workshops, like perhaps those serving Thronos Kephala itself. At the regional level imported coarse stirrup jars at Thronos Kephala shows that, after the collapse of the Late Bronze Age state system, the circulation of, and trade in oil and wine, associated with the production of these vessels had remained active as much as local economic specialization and a trade network still connecting much of the island.

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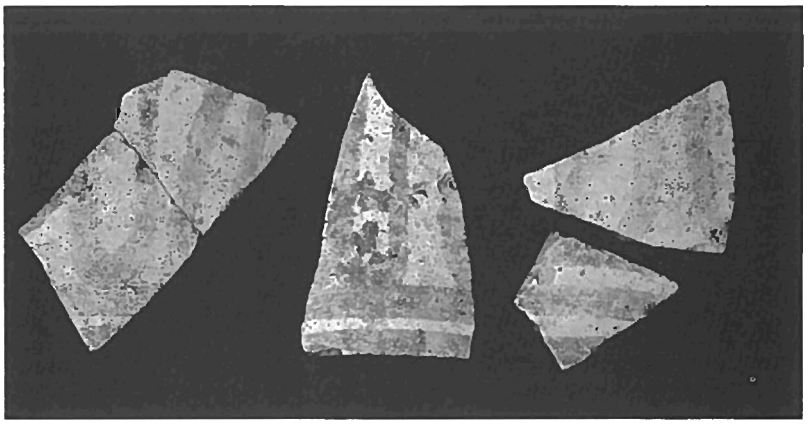
[76] Cf. Hallager 2000, 145.

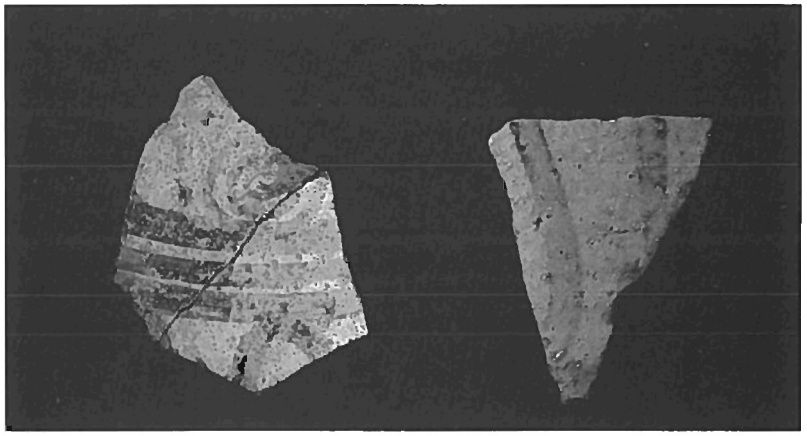
[77] As well as at Thronos Kephala coarse stirrup jars decorated with high wavy band are known in numerous LM IIIC sites: Khania (Hallager 2000, 163-64), Khamalevri (Andreadaki Vlazaki, Papadopoulou 2005, 387, Fig. 52), Kastrokephala (Kanta, Karetsou 2003, 149, Fig. 7A-B), Phaestos (Borgna 2003, 174 and 313, cat. XIIIB2.3, pl. 72.6 and 72.7), Karphi (Preston Day 2005, 434-435, Fig. 1), Kavousi Vronda (Preston Day 2005, 435), Khalasmenos (Tsipopoulos 2004, 108), Praisos Tzani Metochi (Kanta 1980, 181; Kanta 2005, 231, Fig. 7), Mouliana, Tomb B (Xanthoudidis 1904, 43, Fig. 10.233), Palaikastro Kastri (Sackett, Popham, Warren 1965, Fig. 15 P-24). Fragments of vases of the same type are also present in SM deposits at Knossos (Popham 1992, 65, pl. 48b. 9) and at Thronos Kephala.

[78] Maran 2005; Stockhammer 2006; Stockhammer 2008.

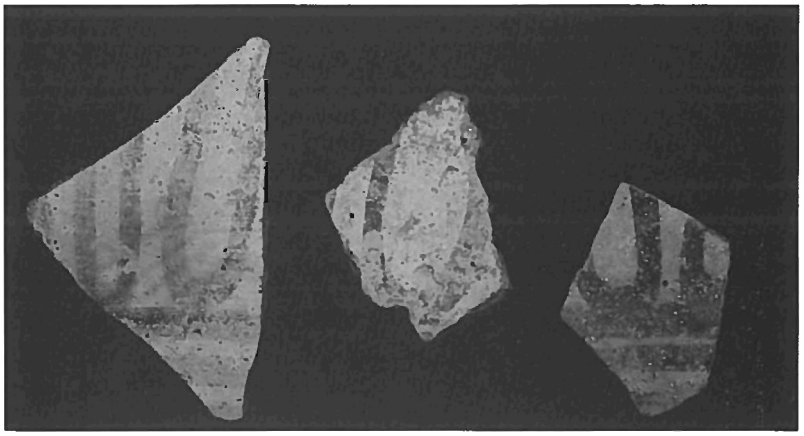
[79] On macroscopic ceramic fabric analysis as a tool for reconstructing patterns of trade and exchange of coarse ware in Aegean prehistory, Moody, Robinson, Francis, Nixon, Wilson 2003.



THK04/72



SY67 SY166



THK08/77 THK05/602 20/11

Fig. 16 – Fragments of coarse ware stirrup jars from Thronos Kephala.

During the Protogeometric period extra-regional ceramic materials continued to find their way to the site, but reflecting a quite different pattern of exchange. Ceramic imports from the north-central and north-eastern region of the islands, and from Eleutherna, are dated to the Protogeometric period. Chemical analysis of the fine pottery from Thronos Kephala will certainly add more data to this picture. The presence of imports from the north-central region of the island goes to explain the stylistic links which local production in the 10th and 9th century BC shows with Knossos. No less significant is the production, as early as the Early Protogeometric period, of types whose introduction at Knossos is considered to reflect the influence of Attic ceramic workshops. In other words, in this phase Knossos seems to have become the chief interlocutor of Thronos Kephala[80].

For the final phase of the settlement of Thronos Kephala the most significant material is that in *Group* 7, whose petrographic composition is linked to the area of Eleutherna. Five fragments are pertinent to contexts LG/EO, while two specimens, SY92 and 159, date from the advanced PG. This is a clear indication of the cultural explosion, and consequent political and economic expansion, experienced by the site of Eleutherna from this phase onwards, resulting in a new relationship linking these two centres.

In conclusion, the research carried out at Thronos Kephala shows that ceramic production in the 12th and 11th century BC, corresponding to LM IIIC and SM, was characterised by the development of a local production, the circulation of ceramic materials produced in the intra-regional area, and a network of relations with other regions of the island (Mesara, Rethymnon coast, north-central Crete). During the 10th century BC, the site took on a different pattern of relationships which undoubtedly reflects the multiple transformations that took place locally[81] and elsewhere on the island. We do not yet have sufficient data to reconstruct the physical characteristic of the whole settlement, its spatial organization and territorial limits in these centuries, but it is from this phase onwards that we can begin to recognise an 'archaic' type of social complexity[82].

Finally, based on the results of petrographic analysis on the pottery of Thronos Kephala it is clear that throughout the whole period in question goods from the intra-regional context circulate at the site. Both the archaeometric and archaeological data point to the existence of intra-regional ceramic productions, that is pertaining to the specific area characterized by geographical and possibly cultural features to which the site of Thronos Kephala belongs. While the identification of regional and supra-regional networks active in a territory constitutes a defining element in the process of reconstruction of a regional identity, the identification of boundaries, i.e. the dimensions of the intra-regional context, has to be pursued at different levels of inquiry. In the first place this will require further specific petrographic analysis of the ceramic from the site, and at the same time draw on the findings of a more wide-ranging geological survey of the surrounding areas which,

[80] See D'Agata 1999.

[81] D'Agata 1999; forthcoming b.

[82] D'Agata forthcoming b.

with few exceptions, are still largely unexplored. In fact, in terms of research priorities, it will be indispensable to proceed with an integrated archaeological survey of the territory, combining archaeological research, geological surveying and palaeo-environmental analysis, making it possible to collate the data gathered for the site with those obtained for its hinterland during the Dark Ages.

APPENDIX. PETROGRAPHIC DESCRIPTIONS OF THE 7 MAIN FABRIC GROUPS[83]

GROUP 1

Subgroup 1a

Microstructure
Dominant to few mesovughs, frequent to few macrovughs, and rare mega planar vughs. Voids are rarely oriented parallel to the edges of the vessel's walls while non-plastic inclusions are randomly oriented. The distribution of the inclusions is double-spaced to open-spaced in the coarse fraction and single-spaced in the fine fraction.

Groundmass
It is heterogeneous, based on abundance of fine fraction and variations in the firing temperatures. It is well fired with an optically inactive to active micromass. The colours range from grey brown, brown, light brown in PPL (x50) to dark grey, light red, reddish brown and orange brown to brown, reddish brown and light brown in XPL (x50).

Inclusions
c:f:$v_{0.125\ mm}$ = ca. 20:70:10 to 35:58:7
The inclusions are poorly sorted with a strong bimodal grain-size distribution. <5.6 mm, a-r, mainly sr.

Fine fraction

Predominant to frequent	**Monocrystalline quartz / feldspar**
Few to very rare	**Serpentinite**
Few to absent	**Calcimudstone**, micrite
Very few	**Biotite** and **yellow** mica laths
	Opaques
Very few to very rare	**Amphibole**
Very rare	**Epidote-group**
	Microquartz chert

[83] Abbreviations used in the descriptions are as follows (after Whitbread 1986; 1989; 1995): Frequency labels: predominant >70 %, dominant 50-70 %, frequent 30-50 %, common 15-30 %, few 5-15 %, very few 2-5 %, rare 0.5-2 %, very rare <0.5 %. Size of voids: mega >2 mm, macro 0.5-2 mm, meso 0.05-0.5 mm, micro <0.05 mm. Angularity of inclusions: a = angular, sa = sub-angular, sr = sub-rounded, r = rounded, wr = well rounded. PPL = plane polarized light; XPL = cross polarized light. The c:f:v ratio expresses the relative proportions of coarse (c), fine (f) components and voids (v) while the boundary between the fine and the coarse components is indicated as a subscript. Concentration features: TCF = textural concentration features, KCF = crystalline (depletion) concentration features.

Coarse fraction

Dominant	**Metamorphic rock fragments:** sa-r, equant to elongated, <5.6 mm, mode 1 mm. Various types and textures: brown reddish phyllite with microquartz lens, elongated-r; very fine yellow phyllite, few fragments with opaques and monocrystalline quartz; coarse phyllites with quartz, mica, opaques, red minerals, foliation or crenulation; quartzite, elongated to equant subgrains with different sizes and texture; quartz-mica-red mineral-opaque schist; angular reddish opaque-quartz-mica schist; feldspar-opaque-quartz schist, some of the opaque minerals are radiating; quartz-chlorite schist.
Common	**Monocrystalline quartz**: sa-r, equant, straight and undulose extinction, fresh looking, very rarely with vermiculite inclusions or with other coloured inclusions. <1.3 mm, mode 0.2 mm.
	Polycrystalline quartz: sa-r, equigranular, sutured and straight subgrain boundaries. <1.5 mm, 0.2 mm.
Very few to rare	**Microquartz chert**: sa-r, equant, some muddy or with tests. <2.8 mm, 1 mm.
	Feldspar: a-sa, plagioclase with multiple or simple twinning. <0.7 mm, mode 0.2 mm.
	Calcimudstone: sa-r, micrite and sparite, fragments turn greyish with higher firing temperature, few with fine sand inclusions of quartz, chert, pyroxene (?), or with hematite staining. <4 mm, mode 1.3 mm.
Rare to very rare	**Mudstone**: sr, red with fine sand-size quartz. <1.1 mm, mode 1 mm.
Rare to absent	**Sandstone**: sr-r, equant, very fine sand-sized inclusions of quartz, mica, amphibole, opaques, set in brown matrix. <3 mm, mode 0.5 mm.
Very rare	**Radiolarian mudstone**: r, 1.4 mm, only in SY131.
	Igneous rock fragment: r, feldspar in red devitrified groundmass. 0.5 mm, only in SY41.
	Feldspar-quartz rock fragment: sr, very weathered, possibly granite. 1.4 mm, only in SY125.
	Augite (pyroxene?): sa, 0.125 mm, only in SY61.
	Rock fragment: sr, coarse muscovite flakes and opaques, 1 mm, only in SY65.
	Serpentinite: r, equant. <0.5 mm, mode 0.125 mm.

Concentration features

There are two kinds of clay pellets: rare opaque to very dark red TCFs with sharp to clear boundaries, <0.4 mm, mode 0.2 mm, sa-wr, and rare brown TCFs with clear to merging boundaries, <3 mm, mode 0.2 mm, r. In SY72 there is post-firing recrystallisation in the micromass. There are rare micrite infillings of fissures in the other samples.

Subgroup 1B

Microstructure
Frequent mesovughs, few macro- and microvughs and rare to absent megavughs. Most voids are slightly elongated. The distribution of the non-plastic inclusions is open-spaced for the coarse fraction and double-spaced for the fine fraction. Voids are weakly oriented parallel to the edges of the vessel's walls while the inclusions are randomly oriented.

Groundmass
Moderately heterogeneous based on difference in colour between the edges and core, and on the presence or absence of crystallitic streaks. It is optically inactive to weakly active with brown edges and a grey core in PPL (x50) and dark red to red edges and dark grey core with buff domains in XPL (x50).

Inclusions
c:f:$v_{0.062\ mm}$ = ca. 20:75:5 to 10:85:5
The inclusions are poorly to moderately sorted with a bimodal grain size distribution. <2.6 mm, a-wr.

Subgroup 1C

Microstructure
Dominant meso- and macrovughs with rare mega planar voids. The distribution of the non-plastics is double-spaced in both coarse and fine fractions. Voids and inclusions are randomly oriented.

Groundmass
Homogeneous. It is optically weakly active in the core and active near the edges. In PPL (x50) the core is brown and the edges light brown, and in XPL (x50) the core is brown or grey brown and the edges light brown or brown.

Inclusions
c:f:$v_{0.125\ mm}$ = ca. 55:30:10 to 35:60:5
The inclusions are poorly sorted with a bimodal grain size distribution. <6 mm, a-sr.

GROUP 2

Subgroup 2A

Microstructure
Dominant meso- and macrovughs, rare micro- and megavughs and rare fissures. The non-plastics have a double-spaced distribution in the coarse fraction and single-spaced in the fine fraction and they tend to be randomly oriented.

Groundmass
It is heterogeneous based on colour and optical activity within a section and between samples. When optically inactive, it is dark grey brown in PPL (x50) and black and red in XPL (x50). The micromass can also be weakly to strongly optically active, with differences between the core and edges of the sherd. It is brown and reddish brown in PPL (x50) and varies from dark brown, reddish brown, brown to yellowish light brown in XPL (x50). The core is usually darker and less optically active then the edges.

Inclusions
c:f:$v_{0.125\ mm}$ = ca. 35:60:5 to 30:55:15
The inclusions are poorly sorted with a bimodal grain size distribution. <4.8 mm, a-wr.

Fine fraction

Dominant	**Monocrystalline quartz / feldspar**
Few	**Biotite** and **muscovite** mica laths
	Micrite
Very few to rare	**Chert**, microquartz
Rare	**Serpentinite**
Very rare	**Augite?**
	Epidote-group
	Clinozoisite
	Amphibole

Coarse fraction

Frequent	**Monocrystalline quartz**: a-r, equant, undulose and straight extinctions. <2.8 mm, mode 0.7 mm.
	Metamorphic rock fragments: sa-r, equant to elongated, graphite flakes are often present, <4.8 mm, mode 2 mm. Various types and textures (granoblastic, foliated, mortar, crenulated): quartzite with well sorted subgrains, silt-size opaque and chlorite inclusions; quartz-brown mineral-yellow mica schist; very fine yellow, red, or brown phyllites; brown mineral and quartz crenulated schist; polycrystalline quartz with straight or sutured subgrain boundaries, well sorted subgrain sizes or mortar textured; calc-schist: calcite-quartz-opaque or brown mineral rock fragment; epidote-feldspar (very weathered) rock fragment; quartz-yellow mica-epidote schist; dark red phyllite with quartz *augen*; muscovite phyllite; biotite phyllite; brown mineral-quartz schist; quartz-opaque mineral schist; quartz-biotite schist with graphite-covered feldspar porphyroblasts (SY 27); quartz-brown mineral-glaucophane schist; shimmer aggregate of muscovite mica; phyllite with segregated bands of mica and quartz.

Common to few	**Feldspar**: a-sr, equant, mainly cloudy, few grains with development of sericite; rare plagioclase with multiple twinning or orthoclase with Carlsbad twinning. <0.3 mm, mode 0.2 mm.
Very few to rare	**Mudstone**: sa-sr, very dark red matrix (hematite?) with rare quartz and feldspar inclusions. <1.5 mm, mode 0.5 mm.
Rare	**Chert**: r, equant, micro- or macroquartz, muddy with rare microfossils. <2 mm, mode 1.4 mm.
	Calcimudstone: sr-wr, micrite with rare quartz inclusions and red iron stains. <2.45 mm, mode 0.24 mm.
Very rare	**Feldspar-quartz rock fragment**: sr, very altered and with coloured inclusions, 1 mm, only in SY97.
	Rock fragment: r, with hematite matrix and large inclusions of chert and polycrystalline quartz. 3 mm, only in SY59.
	Igneous rock fragment: sr, quartz and feldspar in granitic texture, weathered, 1.8 mm, only in SY127.
	Glaucophane: sr, <0.2 mm, mode 0.18 mm. In SY97 and 172.

Concentration features
There are two types of TCFs: few opaque minerals, large fragments could be hematite mudstone, sharp to clear boundaries, <1 mm, mode 0.125 mm, sr-wr; rare red to brown TCFs with sharp to clear boundaries, <0.2 mm, mode 0.17 mm, r-wr. There are also reddish streaks in the micromass, probably the result of clay mixing.

Subgroup 2b

Microstructure
Moderately dense with dominant mesovughs and rare macrovughs, few voids are elongated. The porphyric relative distribution is single-spaced in the fine fraction and open-spaced in the coarse fraction. Voids and inclusions are randomly oriented.

Groundmass
Homogeneous. When optically inactive it is brown in PPL (x50) and dark red in XPL (x50) and when weakly optically active, it is brown in PPL (x50) and brown to reddish brown in XPL (x50).

Inclusions
c:f:$v_{0.125\ mm}$ = ca. 15:80:5
The inclusions are moderately sorted with a unimodal grain size distribution. <3 mm, a-r.

Concentration features
There are very few to rare opaque inclusions in both fine and coarse fractions, black to very dark red (hematite?) with sharp to clear boundaries, often surrounded by void. <0.6 mm, mode 0.10 mm, sr-r.

Subgroup 2c

Microstructure
Dominant mesovughs and rare macrovughs, few voids are elongated. The porphyric relative distribution is single-spaced in the fine fraction and open-spaced in the coarse fraction. Voids and inclusions are randomly oriented.

Groundmass
Homogeneous. It is optically active, brown in PPL (x50) and brown to light brown in XPL (x50).

Inclusions
c:f:$v_{0.125\,mm}$ = ca. 15:80:5
The inclusions are moderately sorted with a unimodal grain size distribution. <2.8 mm, a-r.

Concentration features
There are very rare light brown to yellowish TCFs, probably clay pellets, with clear to merging boundaries. <0.4 mm, sr-r.

GROUP 3

Subgroup 3a

Microstructure
Dominant mesovughs, few macro planar voids and very rare macrovughs. The distribution of the coarse fraction is double-spaced and it is open-spaced in the fine fraction. Voids and inclusions tend to be randomly oriented.

Groundmass
It is homogeneous throughout the section and heterogeneous from one sample to the other in terms of coarseness, colour and optical activity. The micromass is weakly to strongly optically active. The colour is brown, light brown and dark brown in PPL (x50) and dark brown, brown to light brown and dark reddish brown to reddish brown in XPL (x50).

Inclusions
c:f:$v_{0.125\,mm}$ = ca. 35:60:5 to 20:75:5
The inclusions are poorly sorted with a bimodal grain size distribution. <4 mm, sa-r, mainly sr.

Fine fraction

Dominant	**Monocrystalline quartz / feldspar**
Rare	**Mica** laths
Rare to absent	**Micrite**
Very rare	**Chert**
	Epidote-group minerals
Very rare to absen	**Augite**
	Calcite

Coarse fraction

Frequent to common	**Metamorphic rock fragments:** sa-r, equant to elongated, of various types and textures, <4 mm, mode 1.8 mm: coarse muscovite-quartz schist; muscovite-quartz-opaque-epidote schist; clinozoisite-biotite-quartz-feldspar schist; quartz-yellow mica-red mineral schist; feldspar-quartz-epidote schist; very fresh quartz-clinozoisite; coarse muscovite-clinozoisite-quartz phyllite; coarse yellow mica-red mineral phyllite; quartzite with poikilitically enclosed subgrains, unsorted subgrains and with straight boundaries; biotite-quartz schist; epidote-muscovite-red mineral-quartz schist; silver phyllite with crenulation; opaque-quartz-yellow mica schist; muscovite-biotite rock fragment; feldspar-quartz rock fragment.
Common to few	**Monocrystalline quartz**: a-sr, equant, rarely with vermiculite or colourful inclusions, straight extinction. <2.4 mm, mode 0.3 mm.
Few	**Polycrystalline quartz**: sr, equant, equigranular. < 0.8 mm, mode 0.45 mm.
	Feldspar: sa-sr, equant, mainly with sericite development, rare plagioclase with multiple twinning. <0.8 mm, mode 0.3 mm.
Very few to absent	**Muscovite** laths. <0.3 mm, mode 0.125 mm.
	Serpentinite: r, equant, orange to red, with *machen* structure. <0.23 mm, mode 0.125 mm.
Rare	**Chert**: sr, equant, both micro and macroquartz, muddy, some with tests and chlorite or micrite filling. <2.4 mm, mode 0.9 mm.
	Mudstone, hematite?: sr, with quartz inclusions. <0.6 mm, mode 0.5 mm.
Rare to absent	**Calcimudstone**: sr-r, with sparite, calcite or micrite, very rare quartz inclusions. <1.4 mm, mode 0.6 mm.
	Sandstone: r, equant, fine sand-sized inclusions (grades into siltstone with smaller grain size), quartz, feldspar, opaques, red mineral, chert, mica laths between the subgrains. <2.2 mm, mode 0.7 mm.
Very rare	**Clinozoisite**: a-sa, <0.4 mm, mode 0.14 mm.
	Epidote-group minerals: sr-r, <0.24 mm, mode 0.2 mm.
Very rare to absent	**Amphibole**: sa, 0.17 mm, only in SY75.

Concentration features
There are rare KCFs in the form of micrite fillings of fissure and recrystallisation of the micromass in SY126.

Subgroup 3b

Microstructure
Dominant mesovughs, few macro planar voids and very rare macrovughs. The distribution of the coarse fraction is double-spaced and open-spaced in the fine fraction. Voids and inclusions tend to be randomly oriented.

Groundmass
Homogeneous. It is optically active to strongly active, light brown in PPL (x50) and light brown to yellowish brown in XPL (x50).

Inclusions
c:f:$v_{0.125\ mm}$ = ca. 55:35:10 to 40:55:5
The inclusions are poorly sorted with a bimodal grain size distribution. <4 mm, sa-r, mainly sr.

GROUP 4

Microstructure
Dominant meso- and macrovughs and rare meso planar voids. The distribution of the non-plastic inclusions is double- to single-spaced in the coarse fraction and double-spaced in the fine fraction. Inclusions and voids are randomly oriented.

Groundmass
It is homogeneous throughout the section but heterogeneous among sections. The micromass is optically inactive to weakly optically active. When inactive, it is brown in PPL (x50) and very dark reddish brown in XPL (x50) and when it is active, brown in PPL (x50) and brown to reddish brown in XPL (x50).

Inclusions
c:f:$v_{0.125\ mm}$ = ca. 20:73:7
The inclusions are poorly sorted with a bimodal grain size distribution. <3.6 mm, sa-r, mainly sr.

Fine fraction

Dominant	**Monocrystalline quartz / feldspar**
Few	**Biotite** laths
Few to absent	**Micrite**
Rare	**Chert**
	Serpentinite

Coarse fraction

Common	**Metamorphic rock fragments:** sr, equant to elongated, silicates seem to have graphite inclusions. <2 mm, 0.8 mm. Various types: altered garnet (?)-quartz-feldspar-biotite schist; altered garnet (?)-biotite schist; quartz-altered garnet (?)-biotite schist; feldspar-biotite-opaque schist; altered garnet (?)-hematite rock fragment; quartzite; biotite-quartz-feldspar phyllite; quartz-feldspar-silver mica-biotite schist; quartz-feldspar rock fragment; amphibolite (SY156 only).
Few	**Mono- and polycrystalline quartz**: a-sr, equant, undulose extinction, equigranular subgrains. <0.9 mm, mode 0.5 mm.
Very few to rare	**Chert**: a-sr, micro- and macroquartz, grading to radiolarian mudstone with increase of mud content. Few fragments have microfossils or radiolarian tests (in SY156). <3.6 mm, mode 0.8 mm. **Mudstone**: wr, equant to elongated, light grey to almost amorphous, with silt-size quartz inclusions. <2.4 mm, mode 1.6 mm.
Very rare to absent	**Calcimudstone**: sr-r, micrite. <1.2 mm, mode 0.95 mm. Only in SY156. **Sericite** pseudomorphs: sr, only in SY156. **Sandstone**: sa, well sorted quartz in reddish brown matrix. 3.2 mm. Only in SY156. **Weathered basalt**: sr, only in SY14.

Concentration features

There are few to rare red clay pellets, concordant with the groundmass and with diffuse boundaries. <1.1 mm, r.

GROUP 5

Microstructure

Dominant mesovughs and rare macrovughs. The distribution of the non-plastic inclusions is double-spaced in the coarse fraction and single-spaced in the fine fraction. Voids and inclusions are randomly oriented.

Groundmass

It is heterogeneous based on the post-firing recrystallisation and different colours of the matrix. The micromass is optically inactive, light brown or red in PPL (x50) and very dark grey, red or brown in XPL (x50).

Inclusions
c:f:$v_{0.125\,mm}$ = ca. 5:92:3 to 20:77:3
The inclusions are poorly sorted with a bimodal grain size distribution. <2.4 mm, a-wr.

Fine fraction

Dominant	**Monocrystalline quartz** **Microfossils**
Very rare	**Serpentinite**

Coarse fraction

Frequent	**Micritic:** r, same as in the fine fraction. These could be microfossils. <1.2 mm, mode 0.2 mm.
Common to very rare	**Quartzite**: sr-r, equant to elongated, with increase subgrain size it grades into polycrystalline quartz. Unsorted subgrains. <1.6 mm, mode 0.6 mm.
Very few to absent	**Phyllite**: r, elongated, yellow or reddish with silicates. <1.6 mm, mode 0.9 mm.
Rare	**Monocrystalline quartz**: sa-r, equant, straight extinction. <1.6 mm, mode 0.42 mm.
Very rare	**Mudstone:** sr, red matrix with quartz inclusions. 0.6 mm. **Rock fragment**: sr, quartz and feldspar (granite?). 1.2 mm. Only in SY81. **Chert**: sa, microquartz and muddy. 1.1 mm. Only in SY71. **Siltstone**: sr, 0.4 mm. **Schist**: sr, quartz-mica-red mineral. 1.4 mm.

Concentration features
There are frequent red and brown TCFs, as naturally occurring clay pellets, with sharp to merging boundaries. <2.4 mm, r-wr.

GROUP 6

Microstructure
There are very few voids in these samples with dominant micro- and mesovughs and rare to very rare macrovughs. Voids are either randomly oriented or weakly oriented parallel to the edges of the sherd. All other inclusions are randomly oriented and their distribution is open-spaced in both fractions.

Groundmass
It is rather heterogeneous based on recrystallisation of the micromass. It is optically active to inactive. The colour ranges from orange brown in PPL and orange brown to light orange brown in XPL (x50) to brown in PPL and brown to reddish brown in XPL (x50).

Inclusions

c:f:$v_{0.062\ mm}$ = ca. 5:90:5 to 25:70:5

The inclusions are well sorted with a unimodal grain size distribution. <1.2 mm, sa-r, mainly sa-sr.

Fine fraction

Predominant to dominant	**Monocrystalline quartz / feldspar**
Common to few	**Biotite** and yellow mica laths
Rare to very rare	**Serpentinite**
	Opaques
	Micrite

Coarse fraction

Frequent to rare	**Monocrystalline quartz**: sa-sr, undulose extinction, equant. <0.7 mm, mode 0.1 mm.
	Calcimudstone: sr-wr, micrite and sparite, partly depleted in the micromass, equant and rounded, rarely with silt-size silicates or iron depletion features. <0.8 mm, mode 0.2 mm.
Few to rare	**Metamorphic rock fragments**: sa-sr, equant and elongated. <1.2 mm, mode 0.2 mm. Various types: quartzite; polycrystalline quartz; quartz-brown mineral schist; quartz-yellow mica schist; mica-brown mineral-quartz schist; quartzite with red inclusions; biotite-quartz schist.
	Siltstone: sr-r, as part of the clay body with clear to diffuse boundaries; equant and rounded, with silt-size inclusions of quartz, feldspar, serpentinite, mica and amphibole. <1.7 mm, mode 0.6 mm.
Rare to absent	**Amphibole**: sr. <0.2 mm, mode 0.1 mm.
	Chert: sa-sr, equant, very muddy, with radiolarian tests. <2.4 mm, mode 0.4 mm.
	Biotite mica laths. 0.1 mm.
	Feldspar: a, twinned. 0.2 mm.

Concentration features

There are rare ribbons of finer-grained material visible in the micromass as a result of clay mixing as well as few TCFs, brown to reddish brown, neutral density, r-sr, <1.4 mm, mode 1 mm, with clear to merging boundaries. These are pellets naturally occurring in the clay.

GROUP 7

Microstructure
Common mesovughs and few macro planar voids and macrovughs. The distribution of the non-plastic inclusions is double- to open-spaced in both fractions. The elongated voids and inclusions are oriented parallel to the edges of the sherd while the equant inclusions are randomly oriented.

Groundmass
It is homogeneous. The micromass has very weak optical activity. It is grey, brown and reddish brown in PPL (x50) and grey to light brown or dark brown to red brown in XPL (x50).

Inclusions
c:f:$v_{0.125\,mm}$ = ca. 10:83:7
The inclusions are well sorted with a unimodal grain size distribution. <2.2 mm, a-r, mainly sa-sr.

Fine fraction

Predominant to dominant	**Monocrystalline quartz**
Common to very few	**Yellow** mica laths
Very rare	**Epidote-group minerals**

Coarse fraction

Common	**Monocrystalline quartz**: sa-sr, equant, straight extinction. <0.3 mm, mode 0.13 mm.
Very few to absent	**Calcimudstone**: sr-r, micrite. <2.2 mm, mode 0.2 mm.
Rare	**Quartzite**: a-sr, unsorted subgrain size. 0.6 mm.

Concentration features
There are common to few dark grey-black TCFs with sharp boundaries in both the fine and coarse fractions. They have internal cracks and quartz inclusions and the majority have a void around them, suggesting they are clay pellets. <0.8 mm, mode 0.14 mm, r-wr.

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