The Provenance of Greek Black Glaze Pottery:

A Study by Neutron Activation Analysis.

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Jacqueline Anne Scott

Department of Chemistry

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Chapter 1: Introduction.

Abstract.

The examination of Greek Black Glaze pottery at MUCD began with two provenance studies of the southern Greek mainland,[BUR86,TOM88] and one project investigating the origin of a shipwreck.[FOY90] The results from these studies formed the basis of the present study. The aim of which was to find scientific evidence for Black Glaze production sites in southern mainland Greece.

Neutron Activation Analysis, (NAA), was performed on samples from 802 objects from the Geometric to Hellenistic periods found in Euboea, Boeotia, Attica and in the Peloponnese. The re-irradiation of sherds from the three earlier studies produced results in good agreement with the original analysis, hence the results from the earlier studies were incorporated into the present analysis.

Statistical analysis identified fourteen distinct fabrics. Six of these could be attributed to a particular site; Athens, Corinth, Elis, Argos, Sparta and Euboea. The latter group consisted of sherds from Chalkis and Eretria, suggesting a "Central Euboean" source. The Corinthian group contained a selection of Corinthian Handmade ware sherds, suggesting that the Corinthians used a single source for over 600 years.

Of the remaining eight compositional groups, one was identified as a Boeotian source, and another was very similar to Spartan material. The final five fabrics were all Argive in origin; Argive Geometric, three Argive Handmade ware groups and a group containing sherds from Tiryns and Asine. The Argive Geometric group and one of the Argive Handmade ware groups were thought to originate from Argos, however these compositions were different to the Argos sit group, suggesting three different sources were used by Argive potters between 800 and 300BC.

The fourteen compositions were used to investigate trade on a local and

regional basis. Athens, as expected, was identified as a major exporter of fine ware. Attic wares were found in the Argolid, Euboea, Boeotia and at sites in Israel and Jordan. Corinthian pottery was less widely distributed, while Argive pottery was only found within the Argolid. A set of twenty-five museum pieces were analysed to test the validity of NAA as a provenance technique. The majority of the pieces were identified, and those left unassigned were thought to be from non-Greek sites.

The sites of Mycenae, Berbati, Tiryns, Asine and Korakou in Corinthia were important Bronze Age sites. To investigate the correlation of clay through time two Bronze Age databases(ASA74,ATT82) were compared with the results of the present study. Analysis highlighted the problem of dilution, where the addition of a temper to the clay can act as a diluent of trace elements. No similarities were seen between the Classical wares and Early and Late Bronze Age sherds, from the Argolid and Corinthia, after dilution corrections.

This project included sites such as Athens and Corinth, which have been previously analysed by different laboratories and analytical techniques. Comparing the results of these analyses with the present study showed good agreement for Athens, Corinth and Euboea.

Declaration.

No portion of the work referred to in this thesis has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

Copyright.

Dedication.

To Mum and Dad.

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All my pen pals, I promise I will write very soon!

Finally Orinocco

Biography.

In June 1990, the author graduated from Newcastle-Upon-Tyne Polytechnic with a 1st class honours degree in Applied Chemistry. This had involved an industrial placement at ESSO UK Plc. Between July 1988 and July 1989, the author was a member of the Engine Oils Section, R&D Division. During this time she investigated the deposit control of additive packages on the piston ring zone of an engine.

Between 1990 and 1994, the author has been engaged on research in Radiochemistry under the supervision of Dr. V. J. Robinson, at the Department of Chemistry, Manchester University.

List of Abbreviations.

AAS: Atomic Absorption Spectrometry

AG: Argive Geometric Pottery

BSA: British School at Athens

BG: Black Glaze Ware

HW: Handmade Wares

ICRC: Imperial College Reactor Centre, Ascot

MUCD: Manchester University Chemistry Department

NAA: Neutron Activation Analysis

OES: Optical Emission Spectrometry

URR: Universities Research Reactor, Risley

XRF: X-Ray Fluorescence

Chapter 1:

Introduction.

Introduction.

1.1 Outline of the project.

The study of Greek Black Glaze ware has concentrated on two areas of research: the examination of the glaze, and the provenance of the pottery. The latter topic has been restricted to the more widely known production centres, such as Athens and Corinth. It is known that Black Glaze production was widespread, including Southern Italy, but must have also included many local centres on the Greek mainland, in addition to Athens and Corinth. The aim of this project was to find scientific evidence for Black Glaze production sites in southern mainland Greece.

Neutron Activation Analysis (NAA) was used to determine the compositions of 802 samples from the Greek mainland. The majority of the samples were Black Glaze or Black-Figure sherds. The sherds had been supplied from various sources, summarised in Table 1.1.

The foundation of this project was the re-analysis of Black glaze sherds from six Greek sites.[BUR86,TOM88,FOY90] The database was expanded to include additional sites in the Argolid, Boeotia and Euboea, and Argive and Corinthian Handmade wares and Geometric sherds. Having collected this information various avenues were explored.

1)Trade: This was investigated on a local and regional basis. Twenty-five artefacts from the Manchester Museum were analysed to test the validity of NAA as a provenance technique.

2)The Argolid: Pottery from the Early and Late Bronze Ages have been analysed by

Table 1.1

The Source of Sherds Analysed.

Source: Dr A.J.N.W.Prag, Keeper of Archaeology of Manchester Museum.

Site	Samples
Akraiphnion	16 BG/RW
Argos	20 BG
Athens	45 BG
Chalkis	23 BG
Corinth	9 BG
Elis	20 BG
Eretria	20 BG
Halieis	31 BG
Lachish	30 BG
Nemea	23 BG
Olympia	22 BG
Sparta	25 BG
Tanagra	19 BG
Various	25 (Misc)

Source: Museum of Classical Archaeology, Cambridge.

Argive Heraeum	2 AG
Argos	3 AG
Asine	6 AG/LAG
Corinth	20 BG/Cor
Mycenae	29 BG/AG
Perachora	19 Cor
Tiryns	4 AG

Source: Dr B.Wells, Swedish School at Athens (Berbati excavations).

Berbati	61 BG

Source: Mrs U.Polcyk, Freiburg University, Germany (Tiryns excavations).

Tiryns	45 BG

Source: Dr E.French, Director of the British School at Athens.

Chalkis	45 PG/G
Mycenae	20 BG

Source: Dr D.Williams, Dept of Greek and Roman Antiquities, British Museum.

Argive Heraeum	12 AG

Source: Mrs Y.Backe-Forsberg, Uppsala University, Sweden (Asine excavations).

Asine	40 LG/BG/Cor

Source: Dr N.Kourou, University of Athens, Greece.

Argos	44 HW
Corinth	12 HW
Tiryns	105 HW

Source: Dr K.Prag,

Iktanu	1 BG

Key.

BG: Black Glaze, RW: Red Ware, (L)AG: (Late) Argive Geometric,
Cor: Corinthian, PG: Protogeometric, G: Geometric,
HW: Handmade ware.

NAA.[ASA74,ATT82] Comparisons with these databases were performed to investigate any correlation in composition through time.

3)Interlaboratory Comparisons: This project included sites such as Athens and Corinth which had been previously analysed by various methods. The results were compared to identify similarities between laboratories.

1.2 Aegean History.[OXF70, BUR74, PRI74]

At the beginning of the Bronze Age, Crete was the major force in the Mediterranean. On the Greek mainland small fortified settlements were established at Mycenae, Tiryns and elsewhere; The Argolid became the "powerhouse of Greece". These grew in importance, particularly Mycenae which expanded to become one of the most important citadels in the Aegean civilisation. 1500BC saw the start of the Mycenaean Age. Palaces were established at Mycenae and Tiryns. The Mycenaean Age ended dramatically around 1200BC when Mycenae, Tiryns and other Bronze Age citadels suffered fire and destruction. The end of the Bronze Age saw the migration of populations away from the Argolid, to Attica, Euboea and the Aegean Islands. Sites did survive but were diminished and dispersed. Throughout this period Athens appears to have been little affected by any turmoil. From the twelfth century there followed two to three centuries of upheaval and economic collapse perhaps aggravated by the arrival of new settlers from the north. Greek tradition speaks of "Dorian invaders" though recent work is casting doubt on the extent of this "invasion".[PRA94] With the economic revival from the ninth century came a new approach to pottery, the Protogeometric and Geometric styles.

The eighth century saw a wave of westward colonisation into S.Italy, Sicily and

S.France, and also to the eastern Mediterranean. This was led by seafaring states such as the Euboean cities of Chalkis and Eretria, and by Corinth.

A second wave of colonisation into the East led to oriental styles being introduced into Greece. Various styles were developed; at Sparta, Early Laconian, at Athens, Protoattic, and at Corinth, Protocorinthian. The latter dominated the western market for a century, before the sixth century saw the development of Attic Black-Figure ware. Spartan art was still active, but went into decline as Athens' influence grew. Athens soon dominated the western market and continued to do so with Red-Figure ware. This rise of Athens saw the start of a period of great achievements in art, literature, science and politics.

In the Peloponnese, Sparta was the dominant city. In 510BC it formed alliances with other states known as the Peloponnesian League. With the threat of a Persian invasion Sparta formed alliances with its former rivals Argos and Athens. The Greeks defeated the Persians, but Spartan influence declined. Athens' authority grew and it formed the Delian League, which later became the Athenian Empire. The League was set up to safeguard Greek trade in the Mediterranean, and protect the Aegean islands from any Persian attack.

A period of peace followed, before the outbreak of the Peloponnesian War, (431-404BC). This was caused by the fear of Athens' power by Sparta and her allies, including Corinth. The Peloponnesians devastated Attica in 431BC. The Athenians were finally defeated at Aegospotamoi in 404BC, and their empire was dispersed. Sparta, who had won, was greatly weakened and allowed Persia to regain some control in Asia Minor.

The aftermath of the Peloponnesian War saw a period of turmoil with the "Corinthian War", (Athens, Argos and Corinth against Sparta), and conflicts between Athens, Thebes and Sparta. During this time Macedonia grew in power. King Philip

II united the Greek city states in 338BC, but only by defeating them first at the battle of Chaironea.

1.3 Sites.(LEV80,GRA86)

The Greek terrain, of small fertile plains separated by mountain ranges, allowed cities to establish their own independent states. Larger plains, such as the Argive and Lelantine Plains, could accommodate two or more sites. These cities, or *poleis*, were situated in defensible sites, usually on the edge of the plain and close to a water supply. As the major form of transport was by sea, it was advantageous to have a link to a coast.

The typical *polis* was surrounded by thick stone walls, though people lived on both sides of the city walls. The main meeting place of the city was the Agora. This was also used as a market place and religious centre.

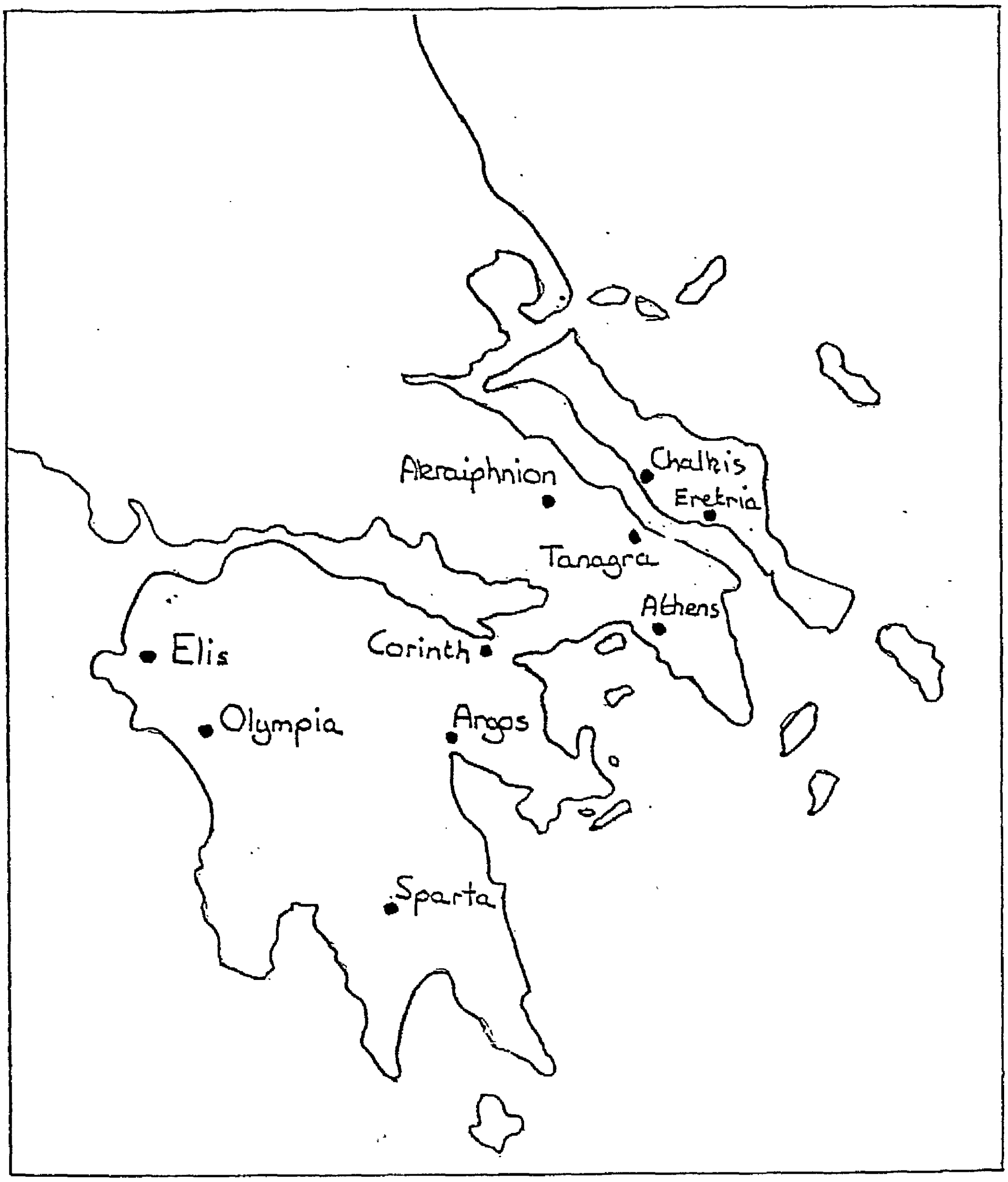
1.3.1 Boeotia.

The region of Boeotia was in central Greece bordering on Phocis in the north and Attica in the south. It had two coasts giving access to the Corinthian Gulf in the west and the Euripos channel, opposite the island of Euboea, in the east.

The major city in Boeotia was Thebes. Her attempts to dominate the region resulted in continued conflicts, and fourteen separate city states remained. These included Akraiphnion, in the north, and Tanagra, on the Attic/Boeotian border. The latter was the chief town in east Boeotia and the site of an Athenian defeat in 457BC. Tanagra was famous for terracotta figurines used in its burial ceremonies. These were thought to originate from neighbouring Athens.

Figure 1.1

Map of the Southern Greek Mainland.



1.3.2 Euboea.

Euboea is an island to the east of Attica and Boeotia. In antiquity it had two main cities on the western coast. Eretria and Chalkis were only 20km apart on opposite sides of the Lelantine Plain. In the eighth century they formed an alliance in order to colonise in the West. This resulted in colonies in Italy, Sicily and Corfu. These were eventually lost to Corinth. The colonists returned to Euboea, but were not welcome and finally settled in the three pronged peninsula renamed Chalkidike.

In the late eighth century Chalkis and Eretria fought for control of the Lelantine Plain. During the seventh century Chalkis became a manufacturing centre, famed for its metalwork.

The fourth century saw Athenian rule at Eretria though it revolted and suffered at the hands of Athens and Sparta. Both cities joined the Athenian League.

1.3.3 Attica.(ARA89)

The region of Attica, which was of a similar size to Boeotia, formed the southern tip of the Greek mainland. Unlike other regions, which were made up of small city states, Attica was ruled by the city of Athens, on the southern side of the region.

In the ninth century Athenian potters began the revolution in pottery styles by producing the Protogeometric style. This matured into Geometric pottery, which spread throughout Greece.

With the introduction of oriental influences into Greece the Athenians developed Protoattic pottery. This was overshadowed by Corinthian pottery, which dominated the market for a century. During this time the Athenian potters perfected the Black-Figure style.

In the sixth century Athens dominated the pottery market with Black-Figure ware and later with its reverse Red-Figure ware. Athens also became the cultural centre for the arts, literature, philosophy and science. This resulted in an increase of population.

With the threat of a Persian invasion, Athens formed alliances with Sparta and other states, taking an active part in the conflict. The resulting victory weakened Sparta's power, and Athens took over. Soon after it formed the Delian League to safeguard Greek trade. This led to a period of peace and once again Athens flourished. In 432BC the Parthenon was completed.

The power of Athens was feared by many states including Sparta. This fear led to the Peloponnesian War. Athens was defeated at Aegospotamoi in 404BC. It quickly recovered and was involved in conflicts between Thebes and Sparta. Throughout this time and into the fourth century Athens continued to undergo a cultural revolution.

1.3.4 Corinthia.(KAR82,ARA89)

Corinthia was an important region for two reasons. Firstly it was the gateway to the Peloponnese, linking the peninsula with the mainland. Secondly it had two coasts, hence access to both the Adriatic, through the Gulf of Corinth, and the Aegean.

During the Mycenaean Age, Korakou, on the southern shore of the Gulf of Corinth, was the most influential site in the region. A small Mycenaean settlement was established at Corinth, on the Gulf. It was this site that became the major power in Classical times. With access to the sea, the Corinthians established colonies on Corfu and Sicily, hence developing trade routes. The colonies would export grain and foodstuffs in exchange for luxury items, such as pottery, jewellery and perfume.

The expansion of the Greeks into the East introduced oriental designs into the home market. Corinthian potters were the first to adapt this style into their own

"Protocorinthian" pottery. During the seventh century Corinth dominated the pottery market. Unfortunately mass marketing produced pottery of increasingly poor quality. In the early sixth century Athens regained the pottery market, with its distinctive Black-Figure Ware. Corinth did attempt to copy the Athenian ware, but was unsuccessful.

The rivalry with Athens led to the Peloponnesian War. Corinth suffered in the conflict losing ships, trade and colonies. In the aftermath of the war, Corinth joined forces with Athens, Argos and Boeotia against Sparta, resulting in the "Corinthian War", (395-386BC). In the Hellenistic period Corinth became the centre for industry.

On a promontory in the Corinthian Gulf, opposite Corinth lay the sanctuary of Perachora. It was dedicated to the goddess Hera, and was controlled by Corinth.

Another sanctuary, at Nemea, was founded on the border of Corinthia and the Argolid. This was dedicated to Zeus. Mythology gives Nemea as the site of Heracles' first labour, to kill the Nemean Lion. The sanctuary became the site of the Nemean Games, initially under the control of the neighbouring town Cleonae, before Argos took over. In 573BC the Games were given Panhellenic status and held in alternate years. In the early fourth century the Games were moved to Argos, where they remained until the Romans reinstated them at Nemea.

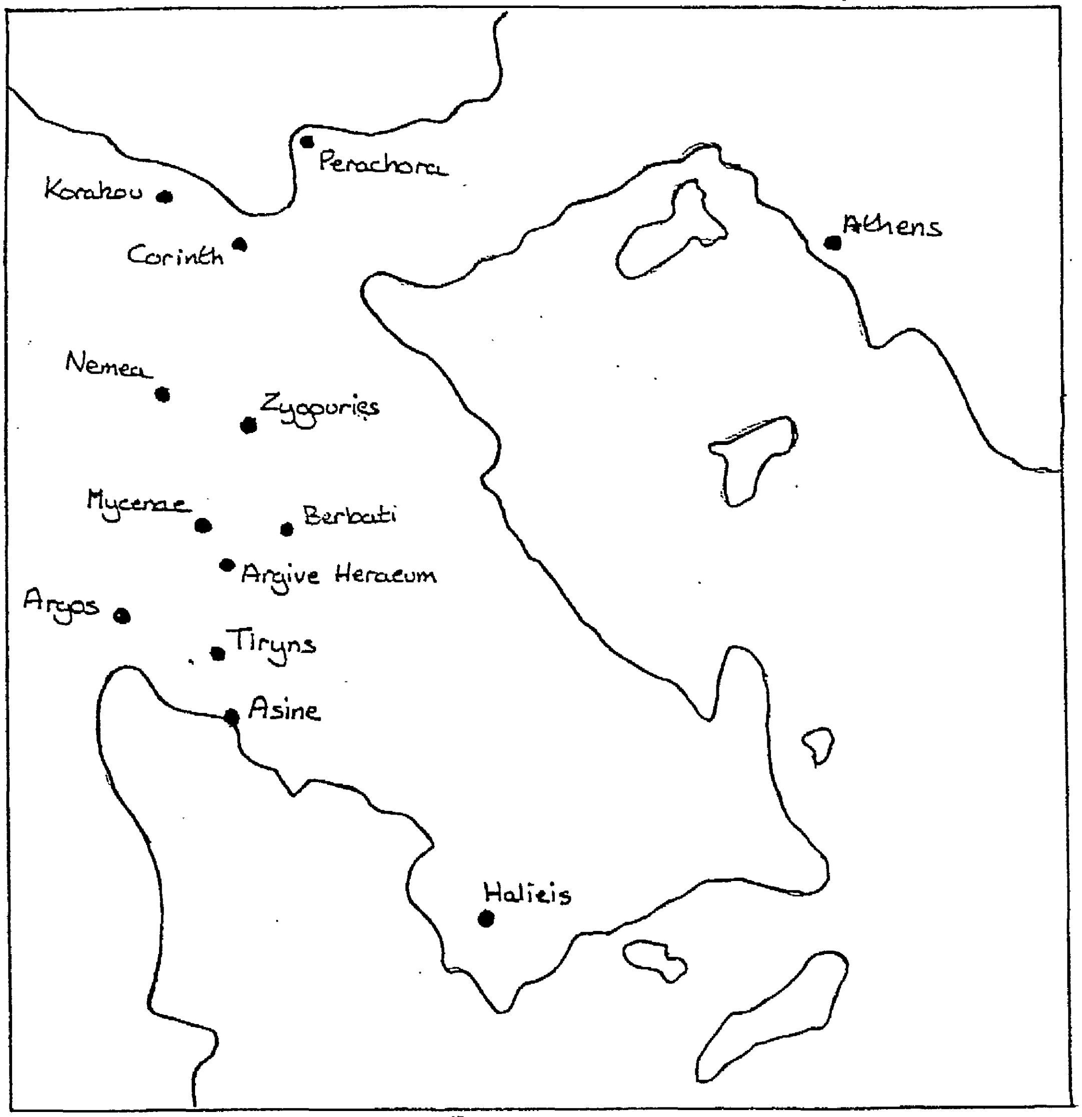
1.3.5 The Argolid.[KAR82]

The central feature of the Argolid is the Argive Plain. This triangular plain stretches from Corinthia to the Argolic Gulf. Towns were found on the edge of the plain, to allow the fertile plain to be cultivated.

In the Bronze Age, Argive communities were among the wealthiest in Greece. The most powerful of these sites was at Mycenae, to the north-east of the plain. During the Late Bronze Age, (the Mycenaean Age), Mycenae controlled the Argolid.

Figure 1.2

Map of the Argolid and Corinthia.



Its destruction, circa 1200BC, led to a period of poverty and upheaval in the region. At Mycenae, survivors of the destruction settled outside the city walls. Diminished in power it soon came under the control of Argos, who destroyed the site in 468BC. In the third century the Argives repaired the Mycenae site, but it never regained its former glory.

Another important Bronze Age site in the north of the Argive plain was Berbati. It was an isolated site, closed off by a set of hills, but close to the main route between Corinth and Argos. The excavations of kilns at Berbati confirms it was a pottery producer during the Mycenaean Age. Like Mycenae, Berbati declined during the Archaic period, before coming under Argive rule.

Close to Berbati and Mycenae was the religious sanctuary at the Argive Heraeum. This was dedicated to Hera, the goddess of marriage and life. It was founded on the site of a prehistoric settlement in the south-west region of the Argive Plain. In Archaic and Classical times the cult of Hera was of significant importance religiously and politically. During this time it was controlled by Argos. In the early fifth century the sanctuary was taken over by Sparta, after defeating Argos. By the fourth century the control of the sanctuary was once again under dispute, between Argos and Mycenae. The Argive Heraeum continued to flourish into Roman times.

Argos was always an important site thanks to its position on the western edge of the Argive Plain. It was on the overland route between Laconia and Corinthia, and the rest of Greece as well as having access to the Argolic Gulf, and sea routes to the Levant and Egypt.

Argos was probably under Mycenaean rule in the Bronze Age. After Mycenae's destruction, Argos developed into a powerful citadel with ruling authority over the Argolid in the sixth and seventh centuries. Sites under Argive influence included Mycenae, Tiryns and Asine.

The rise of Argos caused rivalry with Sparta leading to continued conflict. Argos remained neutral in other conflicts before joining Athens against Sparta in the Peloponnesian and Corinthian Wars.

About 10km from Argos on the Argolic Gulf lay Tiryns. This was the second city to Mycenae in the Bronze Age. It too was destroyed by fire in the 11th century. The survivors settled in the outskirts of the city, where a small site remained under the rule of Argos. In the Classical period, Argos destroyed Tiryns. Survivors escaped to Halieis in the southern Argolid.

Asine was also on the Argolic Gulf coast, about 20km from Argos, separated by Tiryns. Asine had flourished in the Mycenaean, Geometric and Hellenistic periods, and was only incorporated into Argive society in the eighth century. The acropolis is thought to have been abandoned between 700 and 300BC, though the surrounding area continued to be inhabited. Evidence of Protogeometric and Archaic tombs have been found in a field north east of the acropolis.

Finally at the southern end of the Argolid Peninsula lay the important naval base of Halieis. This was under Spartan rule until 470BC, when it was inhabited by refugees from Tiryns. During the Peloponnesian War it was allied to Sparta.

1.3.6 Laconia.

Laconia was in the south-west of the Peloponnese. It was ruled by the city of Sparta, which lay on low hills between two tributaries in the south of the region. Sparta was one of the earliest *poleis*, formed when villages began partnership's based on race and self-sufficiency. The creation of the *polis* at Sparta led to a reduction of villages in Laconia and allowed Sparta to annex the neighbouring region of Messenia in the eighth century. This resulted in a two tier system, with the Messenians treated as Helots, slaves, working the land for the rich Spartans.

Sparta followed an isolationist policy until the threat of a Persian invasion, caused them to expand northwards in the Peloponnese. This expansion caused continued conflict with Argos.

In the sixth century Sparta initiated an alliance with other city states, known as "The Lacedaemonians and their allies", (known today as the Peloponnesian League). One notable absentee was Sparta's old rival Argos.

The Persian Wars united Sparta with Argos and Athens. The aftermath of the war saw Sparta lose its power to Athens. The increasing dominance of Athens brought her into conflict with Sparta, causing the Peloponnesian War. Sparta defeated Athens in 404BC, but her victory was limited. To strengthen her position Sparta allowed Persia to take control of some parts of the mainland.

1.3.7 Elis.

The city of Elis, in the north west Peloponnese was founded after the "Dorian invasion". It was an isolationist state, forming alliances with Sparta, but not involving itself in politics, and was neutral during the Peloponnesian War.

The neighbouring site of Olympia was a bone of contention between Elis and Pisa; it finally came under Elian rule sometime between 572 and 471BC. Olympia was the site of the most famous Panhellenic Games, established in 776BC. Greeks from across the Mediterranean came to celebrate for 5 days in August and September. In the sixth century the sanctuary was dedicated to Zeus. After the fourth century this popularity began to wane.

1.4 Pottery Styles.(COO60)

1.4.1 Early Bronze Age.

At the beginning of the Bronze Age, pottery production on the Greek mainland was influenced by the work of the Cretan potters. One class of pottery used light-coloured linear designs on a dark, lustrous paint. A common shape in the Early Bronze Age was the sauceboat, an elegant drinking cup made of fine fabric. Towards the end of this period the popularity of sauceboats declined. This era also saw an advancement in pottery production with the introduction of the potters wheel. New styles included grey Minyan ware which remained popular into the Middle Bronze Age, where it became more metallic in appearance. The Middle Bronze Age also saw the introduction of a black burnished ware, with incised decoration, known as Argive Minyan. Finally pottery with geometric patterns on dark matt backgrounds emerged.

1.4.2 Late Bronze Age.

During the Late Bronze Age, also known as the Mycenaean period, pottery production in the Argolid was at a height. Mycenaean pottery used Cretan styles painted with a lustrous, shiny glaze. As more cities came under Mycenaean rule, Mycenaean pottery became more standardised.

1.4.3 Geometric Style.

The Geometric style was developed in Athens around 900BC. Decoration was used to emphasize the shape of the vase. This was achieved using geometric patterns such as vertical and horizontal lines, concentric circles, zigzags and later silhouetted figures.

The second most important school of this genre was Argive Geometric,(Plate 1.1, samples AS1079:1, 1822, 1856:4, 2656:1). This used a coarser clay than the Attic style and popularised zigzag and equine motifs. Sherds have been found throughout the Argive plain, (at Mycenae, Argos, Asine etc.). The origin is thought to be Argos, the area's capital.

1.4.4 Argive Monochrome.

Monochrome wares are cheap, functional products. By coating a vase any seepage of contents can be delayed and a smooth exterior can be achieved. The production of Argive Monochrome was at its height in the seventh century, though pieces have been dated as late as 600BC. Argive Monochrome was a plain, unpainted ware, decoration, if any, included incised zigzags and wavy lines. Argive Monochrome was a local ware found mainly around Argos, but distribution suggests Corinth may also have been a producer.

1.4.5 Black-Figure Ware.[SPA70,BEA86]

At the beginning of the seventh century the Greek civilisation was expanding throughout the Mediterranean. The expansion into the East brought an influx of new decorative styles into the home market. Corinth was the first city to adopt this new orientalizing style. Using a black-figure technique, Protocorinthian ware established this new style. Black-figure decoration involved the use of silhouettes of dark colour, with incised or painted designs, on a clay coloured background.[Plate 1.2, AS1477:8] For Corinthian ware this resulted in pale, yellowish vases with brown/black decoration. During the seventh century Corinth dominated the market both at home and abroad. Other sites influenced by Corinth developed the Black-Figure style. Athens perfected it. Attic Black-Figure ware had a distinctive red clay adorned with a good quality black glaze, superior to the glaze used at Corinth.[Plate 1.2 AS5513:1, 1271] Athens soon monopolised the pottery industry, and continued to do so into the fourth century.

Plate 1.1

Geometric Pottery.

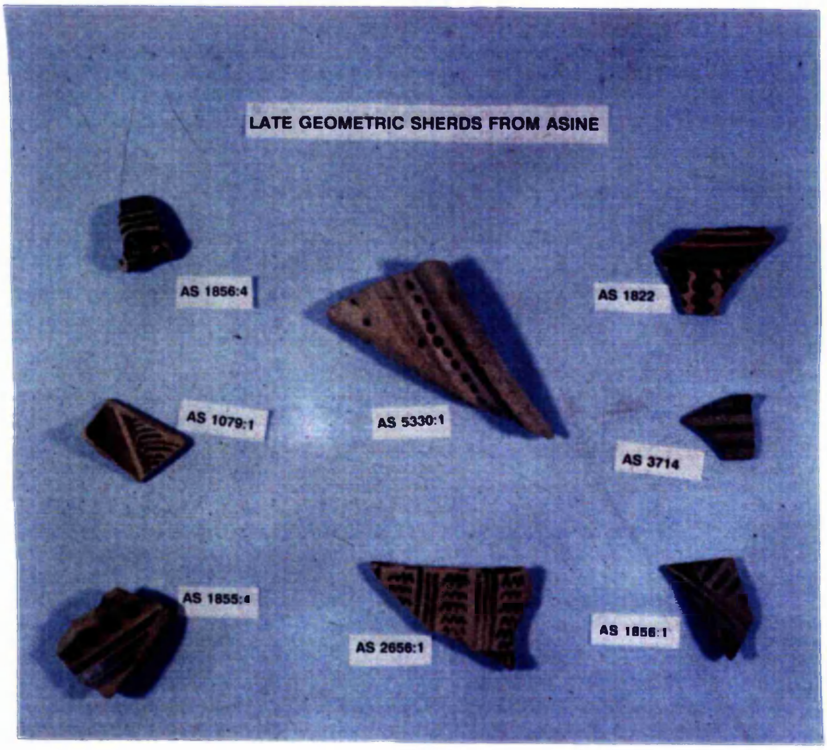


Plate 1.2

Archaic Pottery.

During this renaissance Athens introduced new styles such as Red-Figure ware and Black Glaze ware.

1.4.6 Red-Figure Ware.

The reverse style of Black-Figure ware is Red-Figure ware. Decoration, including everyday and heroic scenes, are outlined by a black glaze. Athens developed this style during the fifth century. Due to the excellent metallic Attic glaze, other production sites could not compete in the marketplace.

1.4.7 Black Glaze Ware.(SPA70,BEA86)

Black Glaze, or black-painted, ware was, again, developed by Attic potters.(Plates 1.3, 1.4) During the sixth century Black Glaze evolved as a less expensive style of Black-Figure ware. It was a plain ware coated completely by a black gloss. The glaze had a metallic quality which was desirable as metal objects were expensive. This characteristic was enhanced by using decorative styles from metal working; (incisions, i.e. ribbing or rouletting).(Plate 1.3, AS4286:3) Other designs used to enliven the black glaze included relief floral patterns and painting.

Black Glaze ware was a very popular ware produced throughout the Greek mainland and imitated across the Mediterranean, particularly in Southern Italy. Attic pottery was still the most prestigious with its shiny, lustrous glaze. Corinth tried to compete, by producing a red coloured clay, but was unsuccessful.

The same manufacturing procedures were used for Black Glaze, Black and Red-Figure wares.(BIN29,NOB60) Firstly the pot was made using either a potter's wheel or a mould. Next, the pottery was decorated. The glaze used was a wash made from a refined iron-bearing form of the clay. The black colour was generated from the three stage firing process.

Plate 1.3

Classical Black Glaze Pottery.

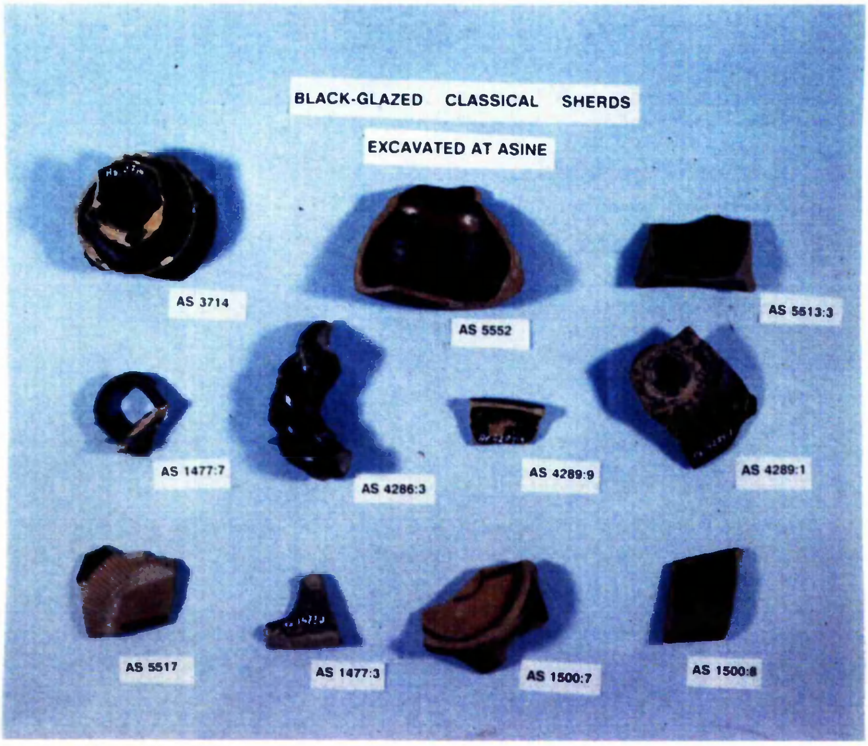
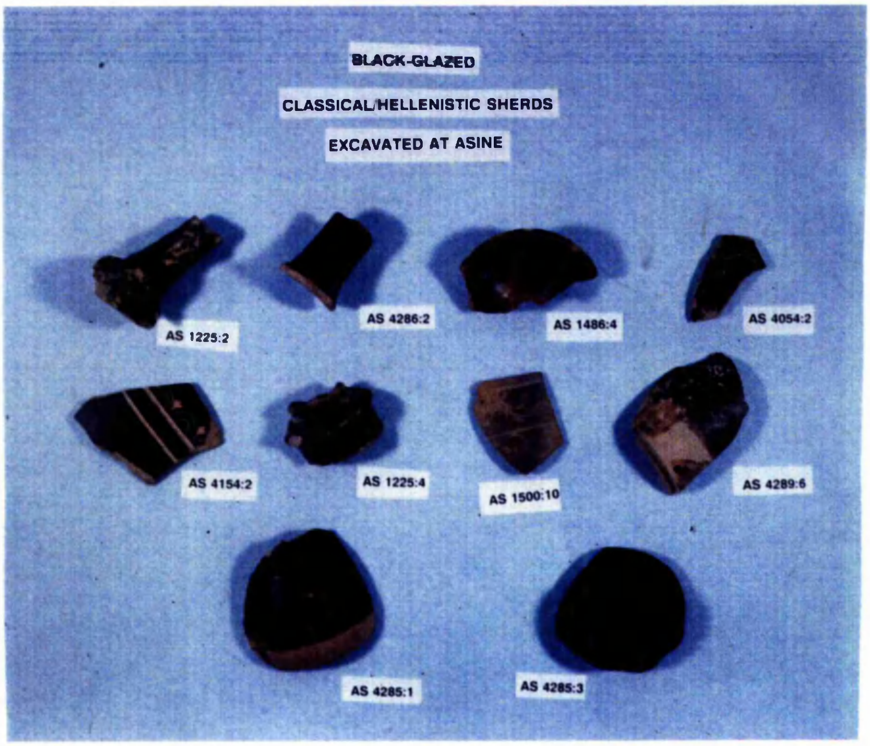


Plate 1.4

Classical/Hellenistic Black Glaze Pottery.



Initially the pot was placed in a kiln with an oxidising environment, the air vent was open and the temperature was about 800°C. Secondly green wood or wet sawdust was added to the kiln, the air vent was closed and the temperature raised by a hundred degrees. This produced a reducing atmosphere. Finally the kiln was cooled with the air vent open.

This firing technique gave a series of colour changes;

A) Oxidising : Red glaze and clay.

B) Reducing : Black glaze and clay.

C) Reoxidising : Black glaze and red clay.

1.5 Chemical Analysis.[PEA70,MAN74,RIC87]

The source of a clay dictates the elemental composition of a ceramic produced from it. Hence as the clay beds in Southern Europe vary, the composition of pottery from these beds must, also, vary. Therefore, determining the elemental composition of a ceramic can pin-point its place of origin.

The constituents of a clay exist at a range of concentrations from major elements, of greater than one percent, to trace elements, at parts-per-million. To produce a real representation of the ceramic matrix the analytical method used must be sensitive to elements throughout this wide range of concentrations. The system should, also, be capable of measuring a large number of elements, as this improves the ability to determine and distinguish between sites.

Techniques which have been used for the provenance of Black Glaze ware by elemental analysis include Optical Emission Spectrometry, (OES), Atomic Absorption Spectrometry, (AAS), X-Ray Fluorescence, (XRF) and Neutron Activation Analysis, (NAA). The latter is discussed in detail later.[Chapter 3] Geological methods have also been applied to pottery analysis, in the form of Thin Section Analysis.

1.5.1 Petrological Analysis.[PRA74,JON86]

Petrological analysis uses the geological features of the clay to identify similarities between different sources. A sample is produced by grinding the sherd to the requisite thickness, and mounting this between glass slides. It is transparent, hence the composition of the clay can be observed by microscope. Variations in the colour, texture and fabric of the clay are examined. In the case of colour, red can identify a ferruginous clay, low in calcium, while a pale colour suggests a calcareous deposit.

Inclusions and minerals considered during analysis include quartz, feldspars, muscovite, biotite, rock fragments and calcite. The latter can be seen as discrete granular grains in the matrix. It can also occur from recrystallisation from solutions after burial.

1.5.2 Optical Emission Spectrometry, (OES).[PRA74]

OES is a simultaneous, multi-elemental technique capable of measuring between 30 and 40 elements. However, only fifteen elements have been measured in pottery analysis to date.

OES is capable of analysing a solid sample directly, eliminating any dissolution problems. The powdered sample is volatilised between two electrodes. Thermal energy excites outer electrons in the atoms, as these return to their ground states, radiation is emitted in the form of light. This light is focused on to a photographic plate to produce an emission spectrum. This is a series of lines of various wavelength and intensities. The wavelengths are specific for a particular element, and the intensities are proportional to the concentration of that element in the sample. Hence, using a comparative method, the composition of the sample can be determined. The accuracy is rather poor by modern statements, with errors of the order of 30% in some cases. Such large errors makes it difficult to differentiate clays of similar composition.

1.5.3 Atomic Absorption Spectrometry, (AAS).[HUG76]

AAS is a more accurate method than OES, with errors of around 5%. However, AAS is a sequential multi-elemental technique, therefore increasing analysis time. Another disadvantage is that the sample must be in solution. This causes problems as mixtures such as Hydrofluoric and concentrated Nitric acids are required to dissolve clays.

Emission radiation of the analyte element is produced in a hollow cathode lamp. It passes through a flame and is focused on to a photomultipliers. The sample solution is injected into the flame, where the vaporised atoms absorb the radiation as it passes through the flame.

Comparison of the analyte spectrum with that of a standard of known concentration gives the concentration of that element in the sample.

1.5.4 X-Ray Fluorescence, (XRF).

XRF like OES can measure a solid directly, hence eliminating any dissolution problems.

A compressed powdered sample is irradiated by primary x-rays. This causes an inner electron to be displaced from an atom. An outer electron then fills the vacancy, any excess energy is released as secondary or fluorescent x-rays. These can be, either, measured directly, or can be focused on to a crystal to cause diffraction.

The secondary x-rays are of characteristic wavelengths for a specific element, and the intensity is proportional to that elements concentration in the sample. To avoid any interference, the primary x-rays have shorter wavelengths than the secondary x-rays.

One disadvantage of XRF is that it only analyses the surface of a sample, therefore making it more useful for glaze analysis. The self absorption of x-rays by the sample also reduces the accuracy of the method, although in modern instruments corrections can be made for this. Under good conditions, and with care, it is possible to obtain data to an accuracy of about 2%.

Chapter 2:

Review of Scientific Studies.

Review of Scientific Studies.

2.1 Introduction.

The examination of Black Glaze and related pottery has followed two directions. Initial studies, with one exception, were concerned with the manufacturing process and the production of the black gloss. With the advent of chemical analyses, emphasis shifted to the identification of sites from the elemental composition of the fabric.

2.2 Manufacture and Colouration.

Various studies [TON08] have examined the composition of the black glaze on Greek vases, and have commented on the presence of iron oxide. Due to the abundance of Athenian ware, analyses concentrated on Attic pottery.

The firing and colouration process was investigated by Binns and Fraser who suggested a three stage firing procedure.[BIN29] This involved an oxidising, a reducing and a re-oxidising atmosphere respectively. The colour change was produced from the reduction and oxidation of iron oxide; ferric Fe_2O_3 being red, and ferrous FeO being black. This technique was clarified by Noble by the re-firing of Attic sherds.[NOB60] The results showed that both the clay and the glaze changed colour through the firing process. Spectrographic analyses determined that the body of the clay and the glaze were of similar compositions. Hence no additional ingredient or pigment caused the black coloured coating. As a result, the chemical reactions involved in the colour changes were determined.

Before firing, both the clay and the glaze were red and remained so during the first stage of firing, in an oxidising atmosphere. A reducing atmosphere was generated by the addition of green wood or wet sawdust to the kiln and closure of the air vent. Due to the lack of oxygen, the green wood or wet sawdust was only partially combusted, producing carbon monoxide, CO, instead of the carbon dioxide, CO_2, more commonly seen. The CO reacted with Fe_2O_3 to produce the black ferrous oxide, FeO.

$$Fe_2O_3 + CO \dashrightarrow 2FeO + CO_2$$

In the presence of water vapour (from moisture in the pottery or additives), the magnetic oxide Fe_3O_4 could be produced. This resulted in a blacker colour than ferrous oxide.

$$3Fe_2O_3 + CO \dashrightarrow 2Fe_3O_4 + CO_2$$

Both these reactions occurred in the clay and the glaze. Therefore, if the firing had been halted, the vase would have been completely and permanently black.

However, the firing process continued with the air vent open. The new supply of oxygen reacted with the ferrous and magnetic oxides to recreate ferric oxide, but this only occurred in the porous clay. The glaze remained black because of sintering. Hence a typical Attic Black Glaze vase was produced, (red clay, black gloss). It was noted that increasing the temperature to ~ 1050C caused the re-oxidation of the glaze to red.

Further evidence of this firing process was seen in misfired pottery. Red patches in the black glaze were a result of cool areas in the kiln, caused by draughts. These did not reach sufficient temperatures for sintering to occur, hence the glaze kept its porosity. During the re-oxidising stage the cool area reverted to red.

The area of study was expanded to include Corinthian pottery.(FAR63,64,70,77) Using mineralogical techniques Corinthian pottery was identified as a calcareous ware. The iron content was sufficient to produce the red-black colour changes, however the high calcium concentration suppressed this causing the characteristic pale coloured clay.(FAR63) The differences between Corinthian and Athenian wares were assessed using thin sections.(FAR64) Corinthian ware contained fine grained $CaCO_3$ inseparable from the clay. This was distinguishable from Athenian ware which contained mineral fragments of quartz, mica and feldspar.

Turning to the manufacture of Black Glaze at Corinth. Experiments,(FAR70) mixing clays and glazes from different sources, showed Corinthian ware did not use an imported glaze, because for example, Attic glaze did not adhere to Corinthian clay. The Corinthian coating resulted in a dull, brown glaze.

Another examination of Athenian glaze was undertaken using Scanning Electron Microscope, (SEM).(TIT82) Attic Black Glaze appeared as an impermeable surface with no clay structure. On the other hand, red glaze had a rough porous texture as seen in the original clay matrix, therefore confirming the hypothesis proposed by Noble.(NOB60) Analysis by electron microprobe gave similar Al_2O_3 to SiO_2 ratios for the clay and the glaze. Hence similar clays are employed for both. The glaze did have a higher iron oxide content and lower inclusions, such as calcium and manganese oxides, than the clay, suggesting that glaze may actually be a refined form of the clay. The presence of FeO in the glaze re-confirms the three stage firing and colouring scheme.(NOB60)

Finally, glaze analyses were brought up to date by another SEM analysis.(MAN93) The Attic black glaze was, once again, verified as having a high iron oxide content. Particular attention was paid to the outer layer of the glaze. This was a completely vitrified layer with fine particles of iron and aluminium oxides, producing a glassy, reflective surface. One problem highlighted by this project was the possibly of compositional changes in the glaze due to weathering. Further analyses are now looking at this problem in detail.

2.3 Provenance Studies.

The earliest chemical analysis of Black Glaze ware examined the composition of Athenian pottery.(RIC1895) A series of reactions were used to determine the concentrations of five elemental oxides in an Athenian vase. This experiment was repeated for three more vases. The results gave similar concentrations for all four vases, hence establishing the first Athenian composition. This demonstrated that provenance studies were possible.

The first major provenance study in this field incorporated petrological techniques and chemical analysis to determine the trade and economic routes of Southern Italy in the Hellenistic period.(PRA74)

Sherds from five sites in Southern Italy and from a well in the Athenian Agora (dated 175-150BC), were chosen to determine if any of the Italian sherds originated from Greece. Petrological analysis proved inconclusive as the mineral suite was too general to separate any sites. However it did suggest a sedimentary source with high calcareous marine deposited clays. These results did imply that the results from a previous petrological study,(FAR64) where pottery from Athens and Corinth were distinguishable, was suspect.

The chemical analysis used was Optical Emission Spectroscopy, (OES). The system was calibrated using the Brookhaven standards, (USGS), allowing direct comparisons with the Brookhaven database. Nine elements were measured, (Na, Mg, Al, Ca, Ti, Cr, Fe, Ni). The Athenian pottery produced a well-defined group, distinguishable by high Cr and Ni and low Ca concentrations. The five Italian sites divided into two groups, one consisting of the three most westerly sites, the other of the remaining eastern sites. This therefore suggested the pottery was locally produced.

An earlier OES study of Archaic Black-Figure vases, using the same standards, was able to distinguish between Athenian, Chalidician and Euboean pottery.[(BOA73)] Again, the Attic group was discriminated by high Ni and Cr values. Comparison of the two OES Attic groups indicated that the same source was used in Archaic and Hellenistic times.

Chalicidian pottery was a highly distinctive sixth century Black-Figure style, mostly found in Italy. One possible origin was the southern Italian colony of Reggio di Calabria, which was founded by Chalkis, Euboea. This pottery was distinguished from Euboean pottery by its magnesium content.

The island of Euboea had two major sites, Eretria and Chalkis. These were only 20km apart, separated by the Lelantine Plain. Pottery from this plain and Late Geometric ware from Chalkis were analysed by OES and found to be of similar compositions, (high Al and low Cr).

Boeotia was the region to the north of Attica and opposite the island of Euboea. Both styles of pottery have been found in Boeotia. This study looked at two vases to establish their origin. Both corresponded to the Athenian group.

Finally a Black-Figure hydria from Manchester Museum was re-analysed by Boardman. Initially this was described as Euboean,[(VON69)] however re-analysis implied it was actually Athenian. This vase has been re-sampled and analysed in the present work by NAA to clear up this matter.[(Chapter 5 5.13)]

Neutron Activation Analysis, (NAA), was used to identify the relationship of pottery from Corinth and Corfu.[(FAR77)] Corfu was a colony of Corinth and fine, pale wares were found at both sites. The concentrations of 18 elements, (Fe, Ta, Sc, Ca, Co, Cs, Cr, Hf, Th, Na, Rb, Lu, La, U, Ti, Mn, Ni, Al), were identified for a number of samples including 40 fine painted Corinth sherds, dated 7-3C. The compositions were similar and exhibited the characteristic high calcium concentration, as seen in petrological analysis.[(FAR64)] Pottery from Corfu was differentiated from the Corinthian ware suggesting local production influenced by Corinthian potters.

In the same year the provenance of Attic and Euboean pottery was examined by X-Ray Fluorescence, (XRF).[(STE77)] This reconsidered the results produced by Boardman *et al*[(BOA73)] where the two styles were separated by Mg, Ti and Al. Semi-quantitative results showed differences for four key elements, (Al, Fe, Mg, K). These four were used to identify the origin of unknown sherds. This proved particularly successful for Athenian pottery.

Another XRF study, this time in conjunction with NAA, determined the origin of the "Thapsos" Class of pottery.[(GRI80)] This was a high quality ware made in the latter half of the eighth century BC Corinth and Aegina were offered as possible origins. To test this, "Thapsos" Class sherds were analysed with samples from Aegina, and Corinth, (Protocorinthian and Late Geometric). 24 elements were measured, 19 by NAA and 5 by XRF. Both types of Corinthian pottery and the "Thapsos" sherds associated, hence confirming Corinth as the origin of the "Thapsos" Class.

A study by Atomic Absorption Spectroscopy, (AAS), of Hellenistic pottery from Benghazi,[(HAT80)] incorporated some of the Prag *et al*[(PRA74)] samples.

The standard used was a Knossos sherd which was analysed by AAS, OES and an external source. The external source and the AAS results were in agreement, highlighting discrepancies in the OES results. The same nine elements were analysed for eleven Athenian and five Italian sherds,[(PRA74)] along with possible Attic and Italian imports excavated at Benghazi.

The results differed for each element, most noticeably for Al, Ca and Fe. This showed the incompatibility of the two systems, as each element needed to be treated by a calibration factor before comparison could begin.

The Athenian group appeared, from the OES results, to be an inhomogeneous group. AAS proved to be a better technique producing a tight group. AAS also showed a greater separation between the Italian and Attic wares. Of the sherds from Benghazi only one set corresponded to the Attic composition, high Cr and Ni.

The next major study(PIK83) investigated Black Glaze pottery using Neutron Activation Analysis, (NAA). Samples were irradiated for 30 to 36 hours and counted for ten minutes after a 6 day delay. This measured twelve elements, (Sc, Ti, Cr, Fe, Co, As, La, Ce, Sm, Yb, Lu, Th), for 42 sherds from Carthage. Three groups were defined, one Attic, one Campanian, from Naples, and one North African. The Attic sherds were dated from the 4th century BC, showing Athens dominance at that time.

The Attic group was compared with the AAS results,(HAT80) however there were only three elements, Cr, Ti and Fe, in common. Due to a low Cr value, the Attic group did not fit with any results from the previous Black Glaze studies.

Provenance studies continued using NAA, this time at Brookhaven National Laboratories.(FIL83) This study investigated various types of pottery found at the Athenian Agora. The sherds analysed included terracotta figurines, trial pieces and kiln wasters. The latter are particularly useful as these misfired objects would have been disposed of locally.

Data was obtained from two irradiations, (Short; 1min, Long; 7hrs), and two counts, (both 2000s, after a few hours and 10-12 days respectively). From this the concentrations of 22 elements were determined, (Na, K, Rb, Cs, Ba, Sc, La, Ce, Eu, Lu, Hf, Th, Ta, Cr, Mn, Fe, Co, Sb, Ca, Zn, Sm, Yb). However only 18 elements were used for statistical analysis, (Lu, Sb, Zn, Sm were removed).

Multivariate analysis found three ceramics types manufactured in the Athenian

Agora over three periods; the Protogeometric, the Subgeometric and the Classical-Hellenistic. The latter period grouping, Group A, contained the Black Glaze kiln wasters confirming that Athens was a manufacturing centre for this fine ware.

Group A also contained Black Glaze sherds from Idalion, Cyprus, Tell el Hesi, Israel,(BIE76) and Southern France, previously analysed at Brookhaven, therefore corroborating the archaeological information that Athens was a major exporter of Black Glaze pottery. As in previous studies, the Attic group was differentiated by high chromium values.

Also included in this study was a group of Corinthian pottery. This gave a disperse group, characterised by a high calcium content. These results agreed closely with those given by Farnsworth *et al*(FAR77) and confirmed that Attic and Corinthian clays were separable.

In the same year, the exportation of Euboean pottery to Cyprus and Crete was investigated using AAS.(POP83) Sherds from Cyprus, Crete and the Euboean sites of Chalkis, Eretria and Lefkandi, on the Lelantine Plain, were analysed. Unfortunately these three Euboean sites were indistinguishable from one another. Therefore, only a "Central Euboean" Source could be defined, characterized by high aluminium.

The majority of the exported wares fitted with this "Central Euboean" group, implying that sites on Euboea sold pottery abroad.

A NAA study at MUCD measured fifteen elements, (Na, K, Sc, Fe, Co, Ga, As, Rb, Cs, Ca, Sm, Eu, Ta, Th, U) for samples from Tunisia, Southern Italy, Sicily and Athens.(WOL86) Included in this study were ten Italian and two Athenian sherds previously analysed by Prag *et al*.(PRA74)

The results confirmed Prag *et al* findings, which identified two Black Glaze sites in Southern Italy. Further comparison was not possible as the two studies had only three elements in common.

A large group of Attic material was defined during cluster analysis. This included sherds from Carthage and the Athenian Agora, indicating the spread of Athenian ware across the Mediterranean. As only one group contained all the Athenian sherds, the same clay source had been used throughout the Classical and Hellenistic periods.

Comparison of these results with a previous NAA study[(PIK83)] and AAS study, [(HAT80)] was difficult as there were only three common elements. However, comparison with the Brookhaven data was possible.[(FIL83)]

The Attic group identified by Wolff *et al*[(WOL86)] was almost identical in composition to the sherds in Group A. The MUCD group contained sherds from Carthage and Motya, corroborating previous evidence showing Athens was a leading exporter of fine wares.

Further studies at MUCD investigated the production of Black Glaze on the Greek mainland.[(BUR86,TOM88,FOY90)] The first investigation[(BUR86)] measured fifteen elements, (Na, Sc, Cr, Fe, Rb, Sb, Cs, Ce, Ca, Eu, Sm, Yb, Lu, Hf, Th), for three sites in the Peloponnese; Corinth (COR), 8 samples, Argos (ARG), 8 samples, and Olympia (OLY), 10 samples. Before cluster analysis Na and Sb were removed. Five clusters were identified.

1: ARG 7,11,18.

2: ARG 2,8, OLY 9,10,12-15.

3: OLY 16, COR 17-21,23.

4: COR 22,24.

5: ARG 6,14,19, OLY 11.

Interelemental correlations were seen for Argos and Olympia sherds.

Correcting for these allowed the three sites to be separated.

Also included in this project were seven Attic sherds from the Athenian Agora. This group formed a tight, isolated group.

These results were included in a wider examination of Black Glaze production sites.[TOM88] This included six sites; Athens, 7 samples, Corinth, 17 samples, Argos, 20 samples, Elis, 20 samples, Halieis, 31 samples, and Olympia, 22 samples. Seventeen long lived isotopes were determined, though only twelve were used for statistical analysis, (Ta, Co, U, Na, Sm were removed).

Multivariate analysis produced two tight groups for Corinth and Athens. The Athenian group also contained one Argive sherd, ARG20, which was an outlier of the Argos samples. Of the remaining Argos sherds, ARG7,11,18, (Group 1),[BUR86] were an outlying group of unknown origin, ARG10 was an outlier, and the bulk of the samples formed two close groups.

1: ARG 5,6,9,14,16,19.

2: ARG 1-4,8,13,15,17.

The Elis sherds were similar, but could be divided into two sub-groups. One Olympian sherd, OLY11, mixed with the Elis sherds. The Halieis sherds split into four groups. One, HAL8,9,12-14,16-18,24,27, associated with the Athenian group, (high Cr, Cs and Rb) suggesting Athens was the production site. The other three groups were close and undistinguishable from Argos samples. Finally the festival site of Olympia was less well defined.

The final study examined the problem of the Datillo shipwreck.[FOY90] Shipwrecks are of interest as they are unambiguous evidence of trade routes and cargoes. This wreck was found in a crater of an active volcano. From its position it was thought to be travelling from Southern Italy or Sciliy.

Eighteen elements were measured for samples from Athens, Sparta (SP) and the shipwreck Datillo. The three groups formed three distinct clusters. Unfortunately comparison of the shipwreck data with the Wolff *et al*(WOL86) data proved unprofitable for identifying the ship's origin. This was thought to be caused by the unusual environment of the active volcano which caused unusual alterations in the composition of the ceramic fabric, notably very high iron values. The Sparta samples were split into two groups, with two outliers, SP28 and 30.

1: SP 16,18,31,32,36,37,39-42,44,48,50.

2: SP 24,26,27,29,33-35,43,45,47,49.

Finally, the Euboean work at Oxford(LEM91) was brought up to date. Using AAS, 10 elements were measured for a set of vases found on Cyprus. These were thought to be imports from either Euboea or Attica. Analysis confirmed that 12 of the vases were Euboean and 3 were Athenian. As in previous analyses the Euboean group was distinguishable by a high aluminium and a low chromium content. These results confirmed the findings of Professor J.N.Coldstream, the archaeologist involved, who had suggested that the Euboeans had trade routes with Cyprus.

2.4 Summary.

Chemical analyses of Black Glaze pottery over the last two decades has produced a definitive composition for Athenian ware with high Ni and Cr. Athens has also been confirmed as a major exporter of Black Glaze throughout the Mediterranean (specifically Cyprus, Israel, Tunisia and France). Corinthian pottery has been identified by its calcareous nature both petrologically and chemically. Unfortunately Euboean sites have been less easy to identify, resulting in a "Central Euboean" source characterised by high aluminium.

Latterly, more production sites have been analysed at MUCD. These have formed the basis of this project. All the Burton(BUR86) and Tomlinson(TOM88) sherds and the Spartan samples analysed by Foy(FOY90) were irradiated for short-lived and some re-irradiated for long-lived elements and the new data included in the present study.

2.5 Bronze Age Studies.

The present study includes a number of sites in the Argolid and Corinthia. Some of these sites were occupied throughout the Bronze Age. The relationship between Classical and Bronze Age wares from these sites was investigated during this project.

A provenance study of Mycenaean pottery by NAA analysed 700 sherds from the Argolid, (Mycenae, Tiryns and Asine), Crete, Cyprus and Israel.(ASA74) The analysis of the Argolid sites identified a "typical Argolid" fabric. This group contained LHIII-I sherds from all three sites. A group containing sherds from Tiryns was similar to the "typical Argolid" fabric, but with lower Ce and Co, and higher Na and Hf concentrations. A third distinct fabric was identified by a group consisting of LHIIIC sherds from Mycenae and LHIIIA, B sherds from Asine.

Mycenaean pottery was further examined by NAA at MUCD.(FRE84) This had analysed coarse and fine wares from Mycenae, Berbati, Tiryns and Zygouries. The results suggested that there were at least three different clay sources within the Argolid during the Bronze Age.

Another investigation of Mycenaean pottery by NAA(MOM88) included a selection of kiln wasters found in and around Tiryns. Kiln wasters are very useful for provenance studies. These misfired or deformed pots would have most probably been discarded after firing, hence close to a kiln. Therefore kiln wasters provide important evidence of a production site. These samples were analysed along with Mycenaean pottery from Mycenae, Berbati, Tiryns and Asine. Statistical analysis identified two clay compositions; one from the northern Argolid and one from the south.

The northern group consisted of sherds from Mycenae, Berbati and some from Tiryns. This group was similar to a group of the Mycenaean pottery excavated at Mycenae.(KAR72) The southern group contained all but three, (which were outliers), of the kiln wasters and sherds from Tiryns and Asine.

Early Bronze Age pottery from sites across the Argolid and Corinthia were studied by NAA.(ATT82) Using 19 elements, 11 different compositional groups were identified. These included four different clay compositions, (M, N, O, V) within Corinthia.

M: Corinthian Plain.

N: Zygouries or the Corinthian Plain.

O: Keramidhaki, Corinthia.

V: Lake Vouliagmeni, Corinthia.

The final group, V, contained EHI-II sherds from Lake Vouliagmeni and some Archaic and Mycenaean sherds, suggesting that its origin was across the Bay of Corinth in the Corinthian Plain.

In the Argolid, compositional groups were identified at Tiryns and Asine. The Tiryns group contained EH1 and Transitional sherds, suggesting that there was a continuation of this source through the Early Bronze Age.

The results of the Early Bronze Age study[ATT82] were compared with the Perlman Database,[ASA74] containing Late Bronze Age pottery, at MUCD.[PAY92] The two studies had 13 elements in common, (Sc, Cr, Fe, Co, Rb, La, Ce, Eu, Yb, Lu, Hf, Ta, Th). The results were in good agreement, particularly for Zygouries and Asine. This suggests that the composition of clay changed very little through the Bronze Age. One anomaly was observed for Tiryns. The Early Bronze Age group did not correspond to the Late Bronze Age composition.

Chapter 3.

Experimental.

Experimental.

3.1 Introduction.

The use of chemical analysis in the provenance study of archaeological artefacts is well established. The chosen technique at MUCD is Neutron Activation Analysis, (NAA), which is discussed in detail in previous studies in this field.(REH89, COL89, TOM91)

3.2 Neutron Activation Analysis.(HAR76, KUL91)

3.2.1 Principles.

The basis of Neutron Activation Analysis is the production of radionuclides by exposing a sample to a neutron flux. This involves the simple nuclear reaction of neutron capture, i.e:

$$^{27}Al + n_{th} \text{ -------> } ^{28}Al + \gamma \text{ (prompt)}$$

$$^{28}Al \text{ -------> } ^{28}Si + \beta + \gamma \text{ (1779keV) } (\beta\text{-delayed})$$

The radionuclide may emit β-delayed γ-rays of characteristic energies, which are detected by a Ge(Li) detector. The rate of this emission is proportional to the concentration of the parent element within a sample. This can be calculated using the following formulae:

$$R_{(t')} = \frac{W\ N_A\ a\ \Theta\ \sigma\ \phi\ \varepsilon}{A} \{1\text{-exp}(-\lambda t')\} \qquad \text{Equation 3.1}$$

$$R_{(t'')} = R_{(t')}\text{exp}(-\lambda t'') \qquad \text{Equation 3.2}$$

where:

$R_{(t'')}$ = net photopeak area (cps)

W = weight of element (g)

N_A = Avogadro's number

a = γ-ray abundance

Θ = natural abundance of activating nuclide

σ = neutron absorption cross section of activating nuclide (barns)

ϕ = neutron flux ($n.cm^{-2}s^{-1}$)

ϵ = detector efficiency

A = atomic weight of element

λ = decay constant (s^{-1})

t' = irradiation time (s)

t'' = decay time (s)

Equation 3.1 includes some parameters, such as neutron cross section, which are difficult to accurately determine.

An alternative method is the direct comparison of a sample with a standard. When a standard is irradiated and counted under identical conditions to the sample, the uncertain parameters can be assumed to be the same for both. Therefore the calculation simplifies to:

$$\frac{\text{Concentration of element i in sample}}{\text{Concentration of element i in std}} = \frac{\text{activity of sample}}{\text{activity in std}}$$

The standard and sample should be of similar shape and composition, in this case; clays. This reduces any possible errors caused by self absorption or counting geometry.

3.2.2 Standardisation.

The standard currently used at MUCD is Podmore Red Clay. This has been standardised at MUCD using primary standards.

During an inter-laboratory comparison, 11 sherds originally analysed by Perlman, at UCLA, were re-analysed at MUCD. From these results the Perlman values for the Podmore standard were estimated. These values were within one standard deviation of the mean values for the seven other independent analysts in the comparison.[TOM91,TAY93] It was, therefore, decided to use the Perlman values for the standard clay. Consequently, all past Manchester data has been corrected to the Perlman values.

Table 3.1.

Podmore Composition: Perlman Values.

Na%	0.0686	Al%	11.44
K%	1.35	Ca%	1.82
Sc	26.00	Ti%	0.679
V	152*	Cr	121
Mn	405	Fe%	5.48
Co	20.00	Rb	84.5
Cs	7.87	La	41.9
Ce	80.1	Sm	7.35
Eu	1.55	Dy	6.13
Yb	3.66	Lu	0.53
Hf	5.48	Ta	1.29
Th	14.0	U	3.05

* This is the original MUCD value, as Perlman did not measure V.

The use of the Perlman values at MUCD has made the direct comparison of all Manchester data with the Perlman-Asaro database feasible. This is advantageous as it can improve site definition and the area of provenance. It has also given the opportunity to compare the MUCD data with other laboratories using the Perlman standard, eg M^cGill University, Canada.

Further developments now make it possible to compare Perlman data with the other major standardisation technique, (United States Geological Standards used at the Brookhaven National Laboratory).[YEH86]

3.2.3 Sample Preparation.

Two preparation procedures were required for the samples analysed. The majority of samples were received as sherds. A clipping of approximately $2cm^2$ was taken using tile-clippers. To ensure no surface contamination or glaze was included in the clay sample, the surface was cleaned with a diamond tipped drill bit connected to a hand held drill. Once clean the clipping was ground to a homogeneous powder in an agate pestle and mortar. The powder was then transferred to a glass tube for drying.

Some sherds were of a delicate nature, (highly curved), and clipping would have caused irrevocable damage. The above procedure was modified for sampling by drill alone. A portion of the sherd was selected for sampling. This was usually a base or a side which would not effect the aesthetic nature of the sherd. The surface was removed using a buffer, (flat edged drill bit). This clean area was slightly larger than the sampling area to ensure there was no glaze contamination. A sample was taken with a conical shaped drill bit. The powder was collected and transferred to a glass tube for drying. This procedure was also used for sampling complete museum pieces where clipping was undesirable.

The samples were dried overnight, at least, in an oven at 120°C, along with the standard, Podmore Red clay. The samples were then weighed into 1ml polythene tubes. These had been cut to a standard length, so each contained approximately 200mg of powder. The mass of each sample was accurately recorded, but care was taken to ensure that the volume of clay in each tube was roughly equivalent. This reduces volume variations giving rise to counting geometry differences when counted on a Ge(Li) detector. Finally, using a soldering iron, the capsules were heat sealed ready for irradiation.

3.2.4 Sample Irradiations.

To maximise the number of accurately measured elements, the samples were irradiated twice and counted three times.

Table 3.2.

Sample Irradiations

	Irrad time	Decay time	Count time	Elements
Short	3mins/90s	20 mins	5 mins	Al,K,Ca,Ti,V,Mn,Dy,U.
Long A	7 hours	1 week	30 mins	Na,La,Sm,Yb,Lu.
Long B	7 hours	2/3 wks	2 hours	Sc,Cr,Fe,Co,Rb,Cs,Ce,Eu, Hf,Ta,Th.

3.2.4.1 Short-lived Irradiations.

These were carried out at the Universities Research Reactor, (URR), Risley and at the Imperial College Reactor Centre, (ICRC), Ascot.

The system used at URR was the fast rabbit. A sample, enclosed in an outer irradiation tube was inserted into the steel rabbit. To ensure each sample was exposed to a similar flux, the sample was held in place by a tissue. Nitrogen gas was used to send the tubes in and out of the reactor. This injection system was computer controlled and activated manually. Samples were irradiated at six minute intervals allowing around 60 samples to be analysed in a session. Standards were irradiated regularly, (1 in 10 samples).

An irradiation time of 3 minutes was used for a reactor power of 100kW. After irradiation a sample was allowed to decay for 20 minutes. This was to reduce the induced ^{28}Al activity to a reasonable, yet detectable level. Due to the high activity the sample was counted at a fixed position 10cm above the Ge(Li) detector. This also ensured each sample had identical counting geometries. The data acquisition system was MAESTRO (EG+G ORTEC). The spectra were saved on disc for later analysis.

The irradiation facility used at the ICRC was the InCore Irradiation System, (ICIS). The flux across the ICIS tube was constant enabling two samples to be irradiated simultaneously. The two samples were packed one above the other in an outer ICIS polythene capsule. This had to be heat sealed, and then ground smooth so it could fit the rabbit. The tubes were inserted automatically by the reactor crew and transported, via piping, to a radioactive storeroom in another building. For activity reasons the irradiation time was reduced to 90 seconds. The decay and counting times remained the same. The data acquisition software used was MAESTRO For Windows and the spectra were again saved on disc.

The samples were counted simultaneously on different detectors. Job programs were used to automatically control each multichannel buffer, (MCB), and save the spectra. This ensured the timings were kept constant. A further safeguard was to include blanks at regular intervals, (1 in 10 samples), to allow time to stop and restart the jobs if necessary.

3.2.4.2 Long-lived Irradiations.

As with the short lived, the long lived irradiations were performed at both the URR, Risley and the ICRC, Ascot.

In both cases 24 samples and 4 standards were irradiated in an aluminium "A" can. The 28 capsules were arranged in four layers of seven. As a check for neutron flux variations, the standards were positioned, differently, in each layer.

At the URR the "A" can was placed in either the 4"x 4" or 1.5" vertical holes. The arrangement at Ascot was slightly different. There were eight available core tubes, each divided into six levels, numbered 1 to 6. The central positions, levels 3 and 4 provided the most constant flux. These were used for our irradiations.

Each "A" can had a full days irradiation. After approximately 5 days decay, (to reduce ^{24}Na activity), the cans were transported back to Manchester for counting. This was done by a Ge(Li) detector linked to a controlling computer. As with the Ascot short irradiations, two samples could be counted simultaneously, (one can per detector). Due to the low sodium content of the Podmore Red clay, the standards were always counted first. To allow for continuous analysis the samples were changed by automatic sample changers.

To allow a full range of intermediate and long lived isotopes to be detected, two counting regimes were employed. These were, after 1 week, a 30 minute count, and after 2-3 weeks a two hour count.

3.3 Gamma Spectrometry.

The process of neutron capture produces β-delayed γ-rays. The energies of which are characteristic of the γ-emitting radionuclide. Hence a radionuclide can be identified by its gamma spectrum.

An irradiated sample is counted on a gamma detector, usually a semiconductor. This device converts the gamma energies into electrical pulses, which are amplified and digitally converted by an ADC, (analogue to digital convertor). These digital signals are then stored in a multichannel analyser, (MCA).

At Manchester the samples were counted on Ge(Li) or High Purity (HP) Ge solid state detectors. During the period of this project the computer system was modernised. The initial system was controlled by a DEC PDPLSI-11/74 linked to a CAMAC, (*c*omputer *a*utomated *m*easurement *a*nd *c*ontrol). This stored the digital signals before a completed spectrum was dumped on the hard disc. The new system was an ORTEC ADCAM 919 connected to a personal computer. This stored the signals in a multichannel buffer, (MCB), until analysis was complete. The spectra were then saved on disc.

3.3.1 Dead time Correction.

The electronic system connected to the detectors can only handle one pulse at a time. Consequently, while the system is processing, no new pulses are detected. The detector appears dead. The "dead time" is then defined as the time, during a count, when the detector is inactive.

The PC based data acquisition systems automatically calculate the dead time and incorporate it into each spectrum. The older CAMAC system used an Ortec 448 research pulser. This emits a pulse of known frequency, which appears in the high energy region of a spectrum. This is so it is easily identifiable and does not cause any interferences in the spectrum. The actual counting time, (the "live time"), is given by:

$$\text{Live Time} = \frac{\text{Pulser Peak Area}}{\text{Pulser Rate}}$$

3.4 Analysis of Spectra.

3.4.1 Data Analysis.

Three data acquistion systems were used to collect spectra. The spectral analysis depended on which collection software had been employed.

3.4.2 Risley.

Short lived.

DATA ACQUISITION: MAESTRO.
DATA ANALYSIS: GRGAN. This was a program specially written for NAA by Dr Gordon Gilmore from the URR, Risley.

Long lived.

DATA ACQUISITION: PDP LSI-11.
DATA ANALYSIS: FIDDLE. This was another program specially written for NAA. This time by Graham Blower.

3.4.3 Ascot.

Short and Long lived.

DATA ACQUISITION: MAESTRO FOR WINDOWS.
DATA ANALYSIS: FIDDLE. This was the 1992 PC version by Nicholas Bryan, based on the original PDP LSI-11 version.

3.4.4 Spectral Analysis.

The three spectrum analysis routines use a similar method. A background region is assigned to either side of the photopeak of interest. The background is given as the average count across all the channels within these regions. Using an algorithm, (eg; straight line; polynomial), the two background regions are joined across the photopeak, and the background counts, below the peak, are summed. The peak area is then simply the sum of the counts within the photopeak region minus the background. The area is corrected for collection time and decay to give a result in counts per second.

Various programs convert the calculated peak areas into concentration data. These compare each peak area with the corresponding mean value for the standard clay. The resultant data is given in a standard format, (atomic number order), ready for statistical analysis.

3.5 Errors in NAA.

When choosing an analytical method it is important to consider the precision and accuracy of the technique. NAA has two forms of experimental error; random and systematic, the effects of which have been evaluated.[COL89,BRY91]

3.5.1 Random Errors.

Random errors effect both the precision and accuracy of a technique. The major source of these errors is counting statistics.

As radioactive decay is a random process, multiple analysis of a sample would produce differing count rates each time. Therefore, introducing an uncertainty, (σ_{AREA}), into the peak area measurement. This is simply defined as the square root of the number of counts.

$$\sigma_{AREA} = \sqrt{N}$$

However this uncertainty also effects the background regions to either side of the photopeak, and must be included in the calculation. Hence the uncertainty in peak area becomes:

$$\sigma_{AREA} = \{ \sigma^2_{PEAK+BKGD} + \sigma^2_{BKGD} \}^{1/2}$$

As the uncertainty is defined by the number of counts, the error is inversely dependent on to the size of the peak. For example, a photopeak of N = 10000 will have an uncertainty of 100, (σ = 1%), but a smaller peak of N = 100 will have an uncertainty of 10, (σ = 10%). In addition, the size of the background will effect the error. For a photopeak in a region of low background, (high peak to background ratio), the background contribution is negligible.

For pottery analysis, K, Yb and Ta are the most affected elements, (σ = 10%).

3.5.2 Systematic Errors.

There are two types of systematic error both affecting only the accuracy of the results. Type A effects a sample by raising or lowering all or some of its elements by an equal factor. Possible sources of this error are sample contamination, weighing, neutron flux variations and counting geometries. Type B effects an element equally through all samples. This can be caused by standard calibration. Type B is not a problem when comparing samples analysed in the same way. However, it must be considered when comparing samples from different laboratories or analytical techniques.

3.5.2.1 Type A: Sample Contamination.

Glaze or sample contamination is negligible as the surface of the sherd is removed at the start of preparation. The major source of sample contamination is, therefore, the preparation of the powdered sample.

The least contaminating procedure is to grind the sample in an agate mortar and pestle.[COL89] However, in some cases it is necessary to collect the sample by drill. Tungsten carbide drills can effect the concentrations of Co, Ta and Cr in the sample.[ATT84] To a lesser extent diamond drills effect the Co, Dy, Cs and Cr contents.[CAR80,COL89]

Two powdering techniques were required for the samples analysed. The majority of samples were ground. The remainder were drilled using a diamond tipped drill bit. Multiple samples were taken using both techniques to estimate any contamination.(Table 3.3)

Table 3.3.

Comparison of Sampling Procedures.

	Clip		Drill		
	UP27	UP45	UP54	UP55	%
Na%	0.699	0.704	0.703	0.723	1.3
Al%	10.0	9.87	9.64	9.98	1.4
K%	3.70	3.50	3.37	2.93	8.3
Ca%	3.58	3.27	3.59	3.57	3.9
Sc	23.1	23.8	23.4	24.7	2.6
Ti	0.559	0.523	0.470	0.449	8.7
V	138	143	146	132	3.8
Cr	315	329	347	344	3.8
Mn	1639	1600	1571	1538	2.3
Fe	6.27	6.45	6.31	6.67	2.4
Co	35.8	37.0	35.6	37.4	2.1
Rb	173	147	140	138	9.3
Cs	8.74	9.10	8.19	8.34	4.2
Ce	41.0	41.3	41.3	42.1	1.0
La	76.1	79.0	77.1	82.0	2.9
Sm	6.77	6.50	6.53	6.70	1.7
Eu	1.50	1.43	1.31	1.37	5.3
Dy	6.35	5.54	5.61	6.03	5.6
Yb	3.21	2.54	3.38	2.94	10.6
Lu	0.463	0.493	0.465	0.481	2.5
Hf	4.95	5.14	4.99	4.81	2.4
Th	13.3	14.1	13.7	13.6	1.9
U	5.53	6.40	6.14	6.17	5.3

The greatest errors were seen for Ti, Rb, K and Yb. The latter two are less reliable isotopes and were within the range expected. The Rb error was due to a large initial value, removing this gave good agreement for the sampling methods. Of the concentrations thought to be effected by drilling, both Co and Dy showed no differences for the two techniques. The chromium concentrations for the drilled samples were higher than those for the clipped samples. Therefore suggesting that there is a slight increase in the Cr concentration when a drill is used to collect the sample. However, this was negligible, and was below the typical standard deviations for a single source. Finally during statistical analysis the four multiples were very closely associated.

3.5.2.2 Type A: Weighing

The accuracy of the weighing procedure is totally dependent on the scales used.(COL89) If a sample is weighed incorrectly, all of its concentrations would be expected to be raised or lowered by the same factor. This factor was calculated for each concentration in a set of standards.(BRY91) Table 3.4 gives the means factor for each counting regime. There is no tendency for these three factors to be the same, hence errors due to weighing are negligible.

3.5.2.3 Type A: Neutron Flux Variations

If a sample is exposed to a neutron flux variation all of the concentrations measured with that irradiation would be expected to be raised or lowered by the same factor.(BRY91) Two irradiations were performed for the present study; a short irradiation and a long irradiation. Therefore, if neutron flux variations are present all the elements measured in the short irradiation would be effected equally, and all the long lived isotopes would be effected equally, but by a different factor to the short irradiations.

During the present study the reactor at which the irradiations were performed was changed. The neutron flux variations at URR, Risley have been assessed in earlier studies.(COL89, BRY91) To identify any neutron flux variations at ICRC, Ascot, a set of standards were irradiated for the long irradiations. The standards were spread across two A-cans in positions 3 and 4 of a core tube. Each standard was in a marked position within the can.

The factor by which a concentration is effected is measured by the variance of that concentration from the mean concentration for an element. This is given as the concentration divided by the mean. The mean factor for each count, short, 30mins and 2 hours, are shown in Table 3.4.

The two long lived mean factors show no relation, hence errors due to neutron flux variations at Ascot are negligible. There is also no tendency for the factors to be related by irradiation position, showing that the neutron flux was constant across the can.

Table 3.4

Analysis of Type A: Systematic Errors.

Std	**Short**	**30mns**	**2hrs**	**Position**
S31	0.998	0.969	1.001	BOTC
S33	1.045	1.021	1.047	FST6
S35	0.986	1.053	1.047	SNDC
S46	-	0.931	0.968	TOP4
S38	1.013	0.994	1.042	BOTC
S40	0.977	0.959	1.024	FST6
S49	-	0.992	0.965	SNDC
T27	-	0.908	0.926	TOP6

Key:

Layers: BOT: Bottom, FST: First, SND: Second, TOP: Top.
Positions in each layer: C: Central position,
4,6: relates to 4 and 6 o'clock on a clock face.

3.6.3 Interferences in NAA.

3.6.3.1 Nuclear Interferences.

Nuclear interferences are caused when an isotope is produced from two or more independent nuclear reactions. This leads to a distortion in the elemental concentration.

The severity of these interferences are dependant on two factors: 1) the absorption cross sections of the competing reactions, and 2) the concentrations of the activating isotopes. Most competing reactions, such as (n,p) and (n,α), are induced by fast neutron absorption. Fast neutrons have lower absorption cross sections than thermal neutrons. Therefore, the probability of fast neutron absorption is low. In addition, in the normal irradiation positions the fast neutron flux is low. Hence, nuclear interferences can be assumed to be negligible unless the interfering elements are of high concentration.

In NAA pottery studies, the effects of nuclear reactions are negligible, (<0.5%), for all but one element.[BEL89,COL89] The exception is magnesium. The isotope ^{27}Mg can be produced from magnesium, $^{26}Mg(n,\gamma)^{27}Mg$, and aluminium, $^{27}Al(n,p)^{27}Mg$. Aluminium has concentrations of $\approx$10% in the clay matrix. Large correction factors are needed because up to 60% of the ^{27}Mg is produced from ^{27}Al. Consequently, the measurement of magnesium at MUCD has ceased.

3.6.3.2 Spectral Interferences.

These occur when the energies of two or more isotopes coincide or are very close. The resultant spectra will show a doublet or multiplet at the relevant energy. A mathematical operation is then required to extract information about the individual peaks.

A simple solution to this problem is to analyse peaks with no interferences. This is possible for almost all the elements determined in pottery analysis. The exceptions are ^{141}Ce, and ^{153}Sm. However, as these interferences make a negligible contribution, mathematical resolution is not necessary.

3.6.3.3 Fission Interferences.

In NAA pottery analysis, uranium is both a detectable element and the cause of interferences. During an irradiation, the isotope ^{235}U undergoes fission. Some of the fission products are identical to isotopes produced from (n,γ) reactions. This leads to an overestimation of elemental concentrations.

Correction factors can be introduced by irradiating pure uranium under identical conditions to the samples. However, the effect on the overall activities of interfered elements, such as samarium and lanthanum, is negligible.(COL89)

Chapter 4:

Statistical Treatment.

Statistical Treatment.

4.1 Introduction.

The use of statistical procedures for the provenance of archaeological data is well established at MUCD,(COL89,REH89) and well documented.(WAR74,BIE76,POL82)

At MUCD, NAA produces the concentrations for 24 elements per sample. Over eight hundred samples have been analysed during this project, and with the possibility of comparisons with a number of databases, statistical analysis is a major undertaking. Clearly to lessen the task, data interpretation must be computer aided. The statistical package used throughout this study was CLUSTAN.(WIS88)

4.2 Multivariate Analysis.

Each sample is assumed to denote a point on a L-dimensional hyperspace, (L= number of elements, in this case a maxima of 24). The distance between any two points is a measure of the similarity or dissimilarity of samples. This is calculated using an extension of Pythagoras' Theorem.

For 2-dimensions:

$$D^2_{(AB)} = [C_{B'} - C_{A'}]^2 + [C_{B''} - C_{A''}]^2 \qquad \text{Eqaution 4.1}$$

For L-dimensions:

$$D^2_{(AB)} = \sum_i^L [C_B(i) - C_A(i)]^2 \qquad \text{Equation 4.2}$$

4.2.1 Data Normalisation.

The concentrations of the elements vary widely within the clay matrix, i.e.

Major	Al	10%
Minor	Ce	80ppm
Trace	Lu	0.5ppm

A method of scaling the data is required to avoid any biased results in favour of the major components. One scaling procedure is to use log data. However this does not correct for the intrinsic variability of an element. A popular technique, which was used in this project, is standard or z-scoring. This defines, in the absence of correlation effects, a "spherical" distribution over the whole population, i.e. each element is assigned the same overall spread.

For an element, (i), in a sample, (A), the z-score, ($Z_A(i)$), is defined as;

$$Z_A(i) = \frac{C_A(i) - \bar{C}(i)}{\sigma(i)}$$

where C(i) and $\sigma(i)$ are the mean and standard deviation of element (i) in the whole population.

As a result of z-scoring, all variables are scaled to a mean of 0.0 and standard deviation of 1.0, hence direct comparisons between variables are possible. This method is strictly only valid when the distribution is normal multivariate, contains only one homogeneous group and the variables are not correlated.

4.3 Cluster Analysis.

Cluster analysis groups samples solely on the basis of their analytical data.

Hence no prior assumptions about the origins of the samples need to be made. For this reason, cluster analysis is the preferred statistical procedure at MUCD. Once groups have been obtained any additional information, (particularly archaeological, i.e. find site, fabric, decoration, chronology, etc.) can be invoked to explain the assignments.

4.4 Hierarchic Methods.

Once the data has been normalised and each sample defined as a point in hyperspace, a method of grouping the data is required. Hierarchic techniques group samples, on the basis of their similarity, to form larger and larger clusters until, ultimately, a single cluster is formed. This process begins with the calculation of the Euclidean distances,(Equation 4.2) between every pairing of samples. To directly compare the distances between sample-sample, sample-cluster and cluster-cluster, an algorithm is needed. Several are available including; nearest neighbour, furthest neighbour, group average and Ward's Method.

4.4.1 Ward's Method.

The most useful hierarchic technique is Ward's Method. This merges samples and groups using the criterion of the "error sum of squares", SS. The SS is defined as the sum, over all samples, of the squared distances between each sample point and the centre of its cluster.

$$SS = \sum_c \sum_i \sum_j [\, M_{ij} - M_{ij}(c) \,]^2$$

where $M_{ij}(c)$ = mean value of element j for cluster c to which sample i is assigned.

Fusion begins with a population of individuals with a SS value of zero. As samples and clusters combine the SS value increases. At each fusion the SS value for every possible step is calculated. The step with the smallest increase in SS is then taken. The process is repeated until a single cluster remains. Ward's Method favours spherical groups, (where the density of points within the group is independent of direction), hence it does not treat groups with substructures favourably.

The fusion of a set of samples using Ward's Method can be represented diagrammatically by a dendrogram. This plots the successive agglomeration of samples and clusters against the dissimilarity coefficient, (for Ward; the sum of squares).

The major disadvantage of Ward's Method is that samples are permanently assigned to groups. However, after subsequent fusions, the structure of a cluster population may change and some samples may no longer fit best with their original assignment. Hence an unreal result is produced. This problem can be overcome using a procedure known as RELOCATE.

4.4.2 RELOCATE.

Using the same algorithm as Ward's Method, RELOCATE reassesses the similarity of each sample after every fusion step. Each sample is removed, in turn, from its cluster, the cluster centre is redefined, and the distances between the sample, its redefined cluster and all other clusters are calculated. The sample is then placed in the "best" cluster, i.e the cluster with the smallest SS increase. This process continues until no more relocations are made and stability is achieved for that clustering level.

The results of RELOCATE involve many changes of sample assignment, they cannot be represented by a dendrogram.

4.5 Outliers.

Outliers are individual samples with very different compositions to the rest of the population. This can be caused by a sample originating from a different site to the bulk of samples, or from anomalous concentrations of individual elements. Due to their large contributions to the standard deviation, when the data is z-scored, outliers compress the residual data for those elements in which they have anomalous concentrations. Consequently, the spherical distribution of the population is distorted and any substructure within the dataset may be concealed. Hence, outliers need to be identified and removed prior to further analysis. This is also true for outlying groups. Cluster analysis is unreliable when trying to identify sub-structure in a cluster which is part of a population containing disparate groups.

4.6 Problems in Cluster analysis.

Two particular problems which may influence the statistical analysis of a certain set of data are;

1) Dilution

2) Interelemental correlations

These are corrected using modified statistical routines.

4.6.1 Dilution.

By adding a temper, a potter can change the physical properties of a clay to achieve a desired effect. For instance, a temper can reduce the threat of cracking during firing. Common tempers, such as sand, (almost pure silica), and limestone, (calcium carbonate), have very low trace element concentrations. Hence, their presence has the effect of lowering the trace elemental concentrations within the clay matrix, i.e dilution. In the case of limestone dilution the calcium content will actually increase. Dilution can also occur naturally, when the composition of limestone or silica varies across a clay bed. Systematic errors, (neutron flux variations, counting geometries), introduced by NAA can cause similar effects as dilution. These effects are restricted to the concentrations of the elements influenced by a variation, e.g. a particular irradiation or counting regime.

The original dilution correction procedure was developed by Mommsen.[MOM88] This has been adapted for MUCD and cluster analysis by Dr.S.M.A Hoffman. The program now used is FACTOR. Because the procedure is intended to deal with the clay matrix, not all elements are suitable for correction. In this study Ca and Mn were not included in the correction program, (Mn can occur as separate mineral grains of Mn oxides). Initially the mean concentration of each chosen element is calculated. The dilution factor, f_i, is defined as the average deviation of each sample element from the mean elemental concentration. The mean dilution factor for each sherd is then given as;

$$f = \frac{1}{L} \sum_{i=1}^{L} f_i \qquad \text{Equation 4.3}$$

where: $f_i = \frac{C_i}{x_i}$ C_i: mean elemental concentration
x_i: elemental concentration

The result for Equation 4.3 is used to modify the data for dilution. The corrected data can then be analysed by statistical analysis.

4.6.2 Interelemental Correlations.

The correlation of two or more elements in a population can lead to problems during cluster analysis. When elements are correlated the concentration of one can be partly deduced from the other. This reduces the number of independent variables which define the z-scored hyperspace. As a result, an ellipsoidal rather than spherical representation of the data is produced. However, cluster analysis will assume a spherical distribution has been created. Hence, the actual volume of the data is exaggerated, and the probability of two nearby groups overlapping is increased. Consequently, an artificial picture of the data is produced.

Interelemental correlations can be determined by the calculating the Pearson product-moment correlation coefficient, (r_{jk}). This is defined as the ratio of the covariance of j and k from the square root of the product of their variances. The covariance is given as the joint variance of j and k from their common mean. The value of these coefficients can vary between -1 and +1. A value of +1 represents a perfect correlation, and similarly r_{jk} = -1 gives a perfect anti-correlation. For truly independent variables the value of r_{jk} will be zero.

Two correlation correction procedures have been instigated at MUCD; Linear Discriminant Analysis,[REH89,COL89] and Principal Component Analysis.[TAY93] Correlations between such elements as Sc and Fe have been detected during this study, however correlated groups separated without the need for correction.

4.7 Other Statistical Procedures.

The Euclidean distance is used at MUCD during cluster analysis. However, other similarity measurements are available. One alternative is the Manhattan or City-Block distance. Both the Euclidean and City-Block distances are specific types of the

Minkowski distance metrics.[(SNE73)] For two samples A and B the distance metric summed over L elements is defined as;

$$D^N{}_{AB} = \sum_{i=1}^{L} (A_i - B_i)^N$$

For an Euclidean measurement N=2, and for City-Block N=1. Both these distances are used within Mahalanobis procedures, which determine the similarity of a sample to a defined cluster.

The use of Mahalanobis methods was developed by Mommsen.[(MOM81)] This was based on the premise that for a normal distribution 60% of the population will lie within one standard deviation of the mean, and 95% will lie within two standard deviations. The technique has been adapted at MUCD by Mr N.D.Bryan resulting in the MAHALA program.[(BRY91)] This measures the distance, (D_M), of a sample from the centre of a cluster along a particular elemental axis.

$$D_M = \frac{X_i - M_i}{SD_i}$$

Where; X_i = Concentration of element i in the sample,
M_i = Mean concentration of element i in the cluster,
SD_i = Standard deviation of element i in the cluster.

The value of D_M for each element in a sample is calculated. A sample is then assigned to a group using the following criterion;

A) 2 out of every 3 elements are within one standard deviation, $D_M \leq 1$.

B) Only 1 out of every 20 elements are beyond two standard deviations, $D_M > 2$.

Mahalanobis procedures can also measure the similarity of two clusters. MAHALA calculates the group-group distances for each element using the same algorithm as is applied to sample-group distances. Two standard deviations are produced A-->B and B-->A. The average is taken and used in the calculation. The average distance over all elements is then derived. From practical use it was found that if the average is greater than unity the groups are statistically separable. If the distance is lower than unity groups are inseparable.

As MAHALA requires information about defined clusters, it is used as a checking procedure after cluster analysis. It can also be used as an indicator to suggest where cluster analysis should begin. This project began by defining groups for known production sites. Any new samples were then compared with these sites using MAHALA. Thus, analysis time was shortened as dissimilar groups were identified at the outset.

Table 4.1.

An Example of MAHALA Output

Sample	**Assign**	**GP1**			**GP2**			**GP3**		
		(A)	(B)	(C)						
S1	GP1	10.34	20	1	16.85	13	4	18.66	10	5
S2	GP2	26.76	9	9	20.33	10	7	30.77	6	8
S3	GP3	15.54	15	2	16.21	14	3	40.88	3	3

Table 4.1 shows the comparison of three samples with three groups using MAHALA. Column A represents the total distance, using modified City-Block, of a sample from a particular cluster. Columns B and C relate to the number of elements with standard deviations less than 1 and greater than 2 respectively. Using this data, S1 is almost certainly a member of Group 1. Likewise S2 is an outlier, as no similarities are seen. Finally S3 is ambiguous, associating to some extent with groups

1 and 2. Hence, cluster analysis should concentrate on groups 1 and 2 only.

4.8 A Practical Approach To Statistical Analysis.

The statistical procedures used at MUCD have been discussed above. How these techniques are used in practice depends on factors such as the pottery type, the area under analysis and the theme of the topic. Throughout this study the following statistical routine was employed.

4.8.1 Single Site Analysis.

Samples were usually supplied in groups defined by their find site. Each find site was analysed separately to determine any relationships between the samples. Initially, this was used to expose any outliers in the population. Using Ward's Method and RELOCATE an outlier can be distinguished by k-linkage nearest neighbour values. Usually a k-linkage>1 represents an outlier. The second or third nearest neighbour value will indicate the presence of an outlying group, (where 2 or 3 samples are very close to one another, but separate from the bulk of samples). Outliers can be detected using MAHALA, but this is usually used to confirm their outlying nature.

After the removal of any outliers, cluster analysis is repeated to determine any substructure within the population.

4.8.2 Dilutions.

Having identified groups within a find site, cluster analysis is performed on corrected data to check for dilution. This can be seen from a dendrogram. If two groups become a close knit cluster after dilution correction, a temper or natural diluent is present.

4.8.3 Correlations.

The correlation coefficients were determined for all the elements within each defined group. Any correlations were noted at this point. If site definition became a problem correlation corrections could then be introduced. This was not necessary for this study.

4.8.4 Comparison of Sites.

Having analysed samples by find site and determined any dilution or correlation problems, groups were compared to see how sites interrelated.

Analysis began with nine sites, and determined seven compositional groups. These seven groups were compared with each other, using cluster analysis. Any similarities were noted and tested by MAHALA. However, the production sites were kept in their original defined groups throughout the study.

As the quantity of data grew separate site comparisons became time consuming. MAHALA was then used as an indicator. Every new set of data was compared with the original seven compositional groups and any newly assigned groups. Analysis could then concentrate on classifying similarities seen with MAHALA.

Finally archaeological information about the sherds was considered in order to explain the results produced.

Chapter 5:

Results and Discussion.

Results and Discussion.

5.1 Introduction.

Neutron Activation Analysis was used to determine the concentrations of 24 elements for 802 sherds, (given in Appendix 1). Multivariate techniques were employed to determine the similarities and dissimilarities between sherds.

There are various strategies available for the definition of production sites. One option takes all the samples as a whole and examines how each sherd relates to one another regardless of find site. The alternative is to initially define the characteristics of each individual site, and then relate these results to the other sites.

The former strategy can be misleading because analysis of a large volume of data can hide some substructure allowing generalisations to be made. On the other hand taking each site individually can be time consuming. It can also lead to the assumption that samples which do not fit a group are outliers, when in fact these are from a different source.

The latter option was chosen for this study. The main reason for this was that the sherds were received over a period of time, hence could not be studied as a whole. This method also allowed the analysis to develop into particular areas of study

Multivariate analysis began with the definition of production sites, initially concentrating on nine sites in Southern Greece. These were examined separately, then compared with each other. Having defined a database, analysis concentrated on three areas of study: festival sites, exportation, and the Argolid. The latter study increased the number of sites and styles examined, to include places such as Berbati, Mycenae and Tiryns, and Argive Geometric and Handmade wares. The Argolid results were then compared with two Bronze Age databases[ASA74,ATT82] to investigate any similarities in clay composition through time.

The inclusion of well defined sites such as Athens and Corinth allowed comparisons with different laboratories and techniques to be performed.

5.2 Multiple Sampling.

To assess the precision of the results obtained during the present study, a selection of sherds, approximately 10% of the total analysed, were multiply sampled.[Table 5.1] Most of these multiple samples were taken from different parts of the sherd, however in some cases, multiples came from the same powdered sample.

The majority of the multiple samples were clipped, however a small selection were drilled to evaluate the errors produced by using different sampling procedures.[Chapter3 3.5.2] These were found to be negligible and within the errors expected for group assignments.

The irradiations were carried out at two reactors, URR, Risley and ICRC, Ascot. To check that the results remained consistent between the two establishments, five sherds from Tanagra, which had been irradiated at URR, were re-sampled and their multiples irradiated at ICRC.[Table 5.2] The elements were in good agreement with the exception of uranium. This was due to the poorer peak definition at ICRC. A better result was achieved by measuring uranium during the short irradiations. As the concentrations from the two reactors corresponded, their results were combined for statistical analysis.

The means and standard deviations for all the multiple samples were calculated. The precision was better than 6% for the majority of elements. Some poorer results were seen for less reliable isotopes such as K, Yb and Ta, which were around 15%.

The presence of minerals in potters' clay, either naturally occurring or as

Table 5.1

Multiple Samples.

Sherd	Multiples	Comments
TAN05	TAN20-23	Irrad'd at both reactors.
TAN09	TAN24-27	"
TAN14	TAN28-31	"
TAN16	TAN32-35	"
TAN18	TAN36-39	"
AS25	AS25B,C	AS25 clipped rest drill.
CO43	CO43B,C	-
TI3	TI3B-D	-
B17	B17B,C	From one clipped piece.
B19	B19B,C	"
B42	B42B	"
BA1	BA1B	"
BA17	BA17B,C	"
MYC11	MYC11B	"
OM108	OM108B	-
OM2A11	OM2A11B	-
OM2B16	OM2B16B	-
OM2C01	OM2C01B	-
OM307	OM307B	-
OM312	OM312B	-
OM322	OM322B	-
OM404	OM404B	-
OM5A06	OM5A06B	-
OM5B05	OM5B05B	-
AM12	AM45,46	-
AM14	AM47	-
AM25	AM48	-
AM30	AM49-51	-
AM41	AM52-54	-
UP03	UP41	-
UP08	UP42	-
UP13	UP43,44	-
UP19	UP53	-
UP22	UP47	-
UP27	UP45,54,55	clip UP27,45/drill UP54,55.
UP29	UP46	-
UP31	UP49	UP31 clipped, UP49 drilled.
UP33	UP50	-
UP36	UP48	-
UP40	UP52	-

tempers, can effect the homogeneity of a clay. For instance, the concentration of limestone may vary across a clay bed, hence the calcium concentration varies producing corresponding variations in other elements. Other elements which show this effect are Cr, Mn and Hf. These problems can sometimes be identified and corrected for using the FACTOR program.(Chapter 4 4.6.1)

Table 5.2

Comparison of URR and ICRC Irradiations.

	URR	ICRC			
	Tan09	Tan24	mean	sd	%
Na	0.922	0.916	0.919	0.003	0.22
Al	10.4	10.5	10.45	0.022	0.21
K	3.12	2.75	2.94	0.187	6.35
Ca	2.04	2.29	2.17	0.125	5.77
Sc	24.5	23.8	24.1	0.326	1.35
Ti	0.492	0.47	0.482	0.010	2.16
V	109	113	111	2.190	1.97
Cr	185	186	185	0.585	0.31
Mn	877	886	887	0.390	0.04
Fe	5.93	5.78	5.85	0.073	1.25
Co	22.7	22.7	22.7	0.004	0.02
Rb	169	192	181	11.67	6.44
Cs	10.6	10.7	10.75	0.038	0.35
La	36.4	36.9	36.7	0.220	0.60
Ce	76.5	75.4	75.9	0.555	0.73
Sm	5.64	6.31	5.98	0.335	5.61
Eu	1.37	1.40	1.39	0.010	0.75
Dy	5.18	4.77	4.98	0.208	4.18
Yb	2.97	2.99	2.98	0.011	0.37
Lu	0.501	0.478	0.490	0.012	2.34
Hf	4.04	4.45	4.24	0.203	4.78
Ta	1.25	1.30	1.28	0.025	1.93
Th	15.0	15.1	15.05	0.063	0.42
U	2.22	1.88	2.05	0.170	8.28

A meaningful assessment of measurement errors can be obtained using the geometrical mean of all the multiple samples. This is the nth root of the product of all n samples.

$$x = [\prod_{i=1}^{i=n} xi]^{1/n}$$

where n: the number of variables
xi: the percentage standard deviation of element i

The geometrical mean is preferred because it reduces the contribution of individual values which depart a longway from the mean.

Table 5.3

Geometrical Mean of 40 Samples.

Na	3.64%	Al	2,20%
K	7.92%	Ca	2.95%
Sc	2.30%	Ti	4.40%
V	2.36%	Cr	2.89%
Mn	2.59%	Fe	2.13%
Co	2.60%	Rb	3.82%
Cs	3.96%	La	2.05%
Ce	2.68%	Sm	2.38%
Eu	4.13%	Dy	4.72%
Yb	8.59%	Lu	6.06%
Hf	3.46%	Ta	11.52%
Th	2.87%	U	8.55%

The results show a precision better than 5% for the majority of elements. As expected poorer results were seen for the less reliable elements K, Yb and Ta. A poor result was also seen for uranium, this was due to the poorer peaks produced in the Ascot irradiations. However, all of the elements were within the typical variation of a single source, approximately 10%. This is particularly important as the results of statistical analysis would be unreliable if the elemental errors exceeded those for a group assignment.

The concentrations of 134 sherds from three earlier studies at MUCD,(BUR86, TOM88, FOY90) were incorporated into this study. These had only measured 15, 17 and 18 elements respectively. To increase the number of elements available, short irradiations were carried out for all these samples. One study(FOY90) had performed short irradiations, however the results were unsatisfactory due to problems with neutron flux variations and were repeated. In addition, a selection of sherds and their original standards were re-irradiated for long-lived elements to assess the repeatability of analyses at MUCD. These sherds were all Black Glaze ware from six sites within the original database.(Table 5.4) The sherds from Corinth and Sparta were re-sampled and analysed as if they were new samples. For the rest of sherds the original samples were re-irradiated with their original standards.

Table 5.4

Re-irradiated Sherds.

Site	BUR86	TOM88	FOY90
Argos	ARG1,14,15,19,20	ARG9,13,16	
Corinth		COR17,19,21	
Elis		ELI1,3,4,7,10,12,13,15,19	
Halieis		HAL7,18,21,27,31,15,19	
Olympia	OLY4,18	OLY6,11,15,17,21,23	
Sparta			SP18,28,31,34,43,47,50

The precision was again better than 5% for the elements measured.(Table 5.5) As this was lower than the typical spread of concentrations within a single source, the results of the earlier irradiations were included in the statistical analysis.

Table 5.5

Geometrical Mean: MUCD Comparison.

Na	3.94%	Sc	1.51%
Cr	3.20%	Fe	1.49%
Rb	5.60%	Cs	4.67%
La	1.46%	Ce	2.59%
Eu	2.09%	Hf	2.77%
Th	2.02%	U	5.68%

Unfortunately the concentrations for ytterbium determined from the second irradiation were consistently higher than those from the earlier studies,(Table 5.6) producing errors ranging from 30 to 60%. Obviously ytterbium could not be included in a reliable study. Hence, it was removed before statistical analysis began. This also eliminated the possibility of sherds being assigned to groups by their ytterbium concentration alone. The concentrations of Co, Eu and Ta were also omitted from statistical analysis, as these had not been measured for every sherd in the earlier analyses. During the present study problems in the low energy region of the spectrum caused some samarium peaks to be distorted, hence Sm was also removed before statistical analysis. Consequently, 19 elements were used in the multivariate analysis.

Na, Al, K, Ca, Sc, Ti, V, Cr, Mn, Fe,

Rb, Cs, La, Ce, Dy, Lu, Hf, Th, U.

5.3 Single Site Analysis.

Nine sites from the Peloponnese, Attica, Boeotia and Euboea were analysed separately to establish the composition profiles of the individual sites. This analysis involved the identification of outliers. These are individual samples with very different compositions to the bulk of the population. This can be due to anomalous concentrations for individual elements or by a sample originating from a different site to the rest of the samples. The latter can be resolved by the comparison of sites. The presence of an outlier within a dataset can cause any substructure of the samples to be concealed. Hence, outliers need to be identified and removed prior to further analysis.

Statistical analysis can also be influenced by dilution or interelemental

Table 5.6

Ytterbium Concentration Comparisons

Sherd	Irradiations TOM88	NEW	Mean	SD	%
ARG01	0.863	2.508	1.685	0.823	48.8
ARG08	0.884	2.311	1.597	0.713	44.6
ARG09	1.078	2.620	1.849	0.771	41.7
ARG13	0.956	2.443	1.699	0.743	43.7
ARG14	1.136	3.022	2.079	0.943	45.4
ARG15	0.887	2.805	1.846	0.959	51.9
ARG16	0.887	3.148	2.017	1.131	56.1
ARG19	1.006	3.033	2.019	1.014	50.2
ARG20	0.914	2.450	1.682	0.768	45.7
COR17	0.680	2.014	1.347	0.667	49.5
COR19	0.742	2.534	1.638	0.896	54.7
COR21	0.734	2.420	1.577	0.843	53.5
COR22	0.575	3.006	1.790	1.215	67.8
COR23	0.664	2.631	1.647	0.984	59.7
COR24	0.526	1.882	1.204	0.677	56.3
ELI01	0.781	2.983	1.882	1.101	58.5
ELI03	0.767	2.804	1.786	1.018	57.0
ELI07	0.761	2.626	1.694	0.932	55.0
ELI10	0.757	2.966	1.862	1.104	59.3
ELI12	0.753	2.094	1.424	0.671	47.1
ELI15	0.849	2.349	1.599	0.750	46.9
ELI19	0.848	2.514	1.681	0.833	49.6
HAL12	0.773	1.295	1.034	0.261	25.2
HAL27	1.139	2.981	2.060	0.921	44.7
HAL31	1.068	2.616	1.842	0.773	42.0
HAL33	1.189	2.993	2.091	0.902	43.1
HAL37	1.271	3.066	2.168	0.897	41.4
OLY06	0.705	1.434	1.069	0.365	34.1
OLY07	0.814	3.277	2.046	1.232	60.2
OLY11	0.851	2.490	1.671	0.819	49.1
OLY15	0.827	3.021	1.924	1.097	57.0
OLY17	0.819	1.784	1.302	0.482	37.0
OLY21	0.540	1.496	1.018	0.478	46.9
				mean	**49.2**
				geometrical mean	**48.4**

correlations, leading to an artificial picture of the data. Dilution effects are caused by the presence of a temper or systematic errors. These have the effect of lowering the trace elemental concentrations within the clay matrix, i.e dilution.

Two elements are said to correlated when the concentration of one can be partly deduced from the other element. This reduces the number of independent variables which define the z-scored hyperspace.

These effects need to identified and corrected for to allow a true representation of the data to be seen. Dilution is corrected for using the FACTOR program.[Chapter 4, 4.6.1] Correlations can be determined by calculating the Pearson product-moment correlation coefficients. Any correlations can then be corrected for using modified statistical treatments.[Chapter 4, 4.6.2]

Once outliers have been removed and any dilution or correlation effects have been identified any substructure (e.g two distinctive groups) within a site is determined.

5.3.1 Boeotia.

5.3.1.1 Akraiphnion.

Sixteen sherds from Akraiphnion, (AK20, 21, 23-36), the most northerly site in the project, included one possible local kantharos, one red ware and 14 Black Glaze sherds. Statistical analysis highlighted three outliers, (AK20, 29, 36), including the local kantharos sherd. On the removal of these outliers, two groups appeared.

GP 1: AK21, 23-25.

GP 2: AK26-28, 30-35.

The groups were distinguishable by the high aluminium content of Group 1.

No dilution or elemental correlations were identified.

5.3.1.2 Tanagra.

19 Black Glaze sherds from Tanagra, (TAN01-19), were analysed along with 20 multiple samples, (5 sherds sampled 5 times).[Section 5.1] Cluster analysis produced one outlier, TAN10, and an outlying group, containing TAN09 and its multiples TAN24-27, hence only one outlying sherd. The remaining sherds formed a homogeneous group. Again no dilution or elemental correlations were observed.

5.3.2 Euboea.

5.3.2.1 Eretria.

Twenty Black Glaze sherds from Eretria, (E01-20), on the island of Euboea were analysed. Only one outlier, E11, (experimental, due to erroneous long-lived results), was identified. The remaining sherds divided into two groups.

GP 1: E06, 10, 12, 16, 17.

GP 2: E01-5, 7-9, 13-15, 18-20.

These were differentiated by the higher chromium concentrations of Group 1. No dilution effects were detected, although a Sc/Fe correlation was identified.

5.3.2.2 Chalkis.

The other main Euboean site of Chalkis was only 20km from Eretria. Two sets of samples were analysed; 23 Black Glaze sherds, (C1-6, 41-56), and 41 Late Geometric sherds, (CH01-8, 11-16, 18, 20-27, 29-39, 41, 43-45). The Black Glaze analysis revealed four outliers, (C6A, 6B, 46, 47) and a four member group, (C4, 41, 45, 56). The rest of the sherds formed one group.

The Late Geometric sherds were more homogeneous with only four outliers, (CH01, 4, 13, 39). These all contained low V concentrations, but did not form a group.

Combining the datasets resulted in the amalgamation of the two larger groups. These results suggested that the same or a similar clay source was used in the Geometric and Classical periods. As with the Eretrian sherds, there was no discernable dilution effect, only a correlation between Sc and Fe was observed.

5.3.3 Athens.

Forty-five sherds, (AG01-45), from the Athenian Agora, dated 500-300BC, were analysed.

Cluster analysis identified 9 outliers, (AG02, 4, 10, 12, 20, 22, 30, 33, 41), due to anomalous concentrations of individual elements. The remaining sherds formed a tight, homogeneous group unaffected by dilution or correlation. The Attic group is very distinct and recognisable.(Table 5.7)

5.3.4 Corinth.

The Corinthian samples consisted of nine Black Glaze sherds from the American Excavations at Corinth, (COR),(TOM88) and 20 Corinthian sherds, (CO), sampled at the Museum of Classical Archaeology, Cambridge. Initial analysis produced two diffuse clusters and four outliers, (COR22, 24, 34, CO46). The clusters remained unchanged after the removal of the outliers.

1) CO18,41,43,66,93,111,139,140,142.

2) CO59,86,90,96,100,102,107,109,112,136.

Table 5.7

The Athenian Group Composition.

Element	Mean	SD	%
Na%	0.563	0.06	10.65
Al%	9.16	1.01	11.07
K%	3.00	0.29	9.82
Ca%	4.03	0.97	24.12
Sc	24.1	1.91	7.91
Ti%	0.512	0.05	9.91
V	122	17.1	13.92
Cr	567	49.8	8.78
Mn	793	106	13.36
Fe%	6.05	0.25	4.06
Rb	159	12.6	7.87
Cs	13.5	1.41	10.43
La	34.1	2.94	8.63
Ce	72.4	4.22	5.83
Dy	4.93	0.60	12.24
Lu	0.423	0.04	9.63
Hf	4.04	0.46	11.47
Th	12.9	2.00	15.47
U	2.20	0.30	14.01

Table 5.8

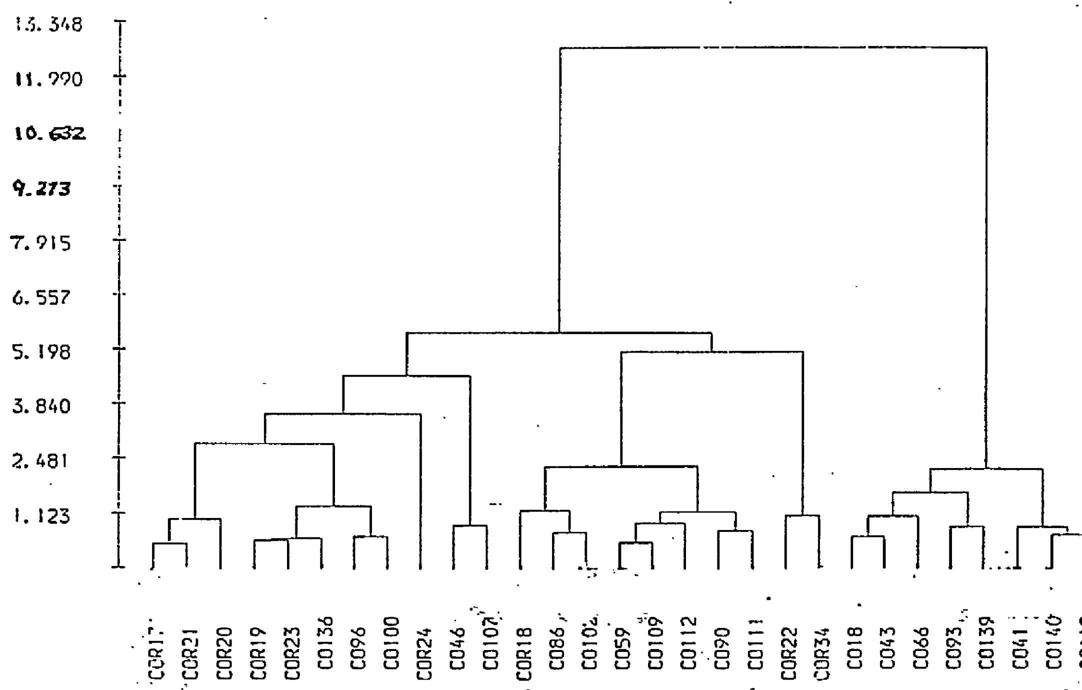
The Corinthian Group Composition.

Element	Mean	SD	%
Na%	0.527	0.12	23.19
Al%	8.04	0.70	8.74
K%	2.21	0.38	17.16
Ca%	10.7	1.83	17.12
Sc	23.1	2.02	8.78
Ti%	0.461	0.05	11.64
V	134	16.8	12.55
Cr	256	25.3	9.87
Mn	950	94.0	9.90
Fe%	5.86	0.51	8.77
Rb	144	18.5	12.77
Cs	9.45	1.01	10.64
La	33.8	2.25	6.65
Ce	61.8	5.39	8.72
Dy	4.47	0.43	9.72
Lu	0.413	0.05	11.76
Hf	3.35	0.45	13.56
Th	11.6	0.92	7.90
U	3.44	0.61	17.63

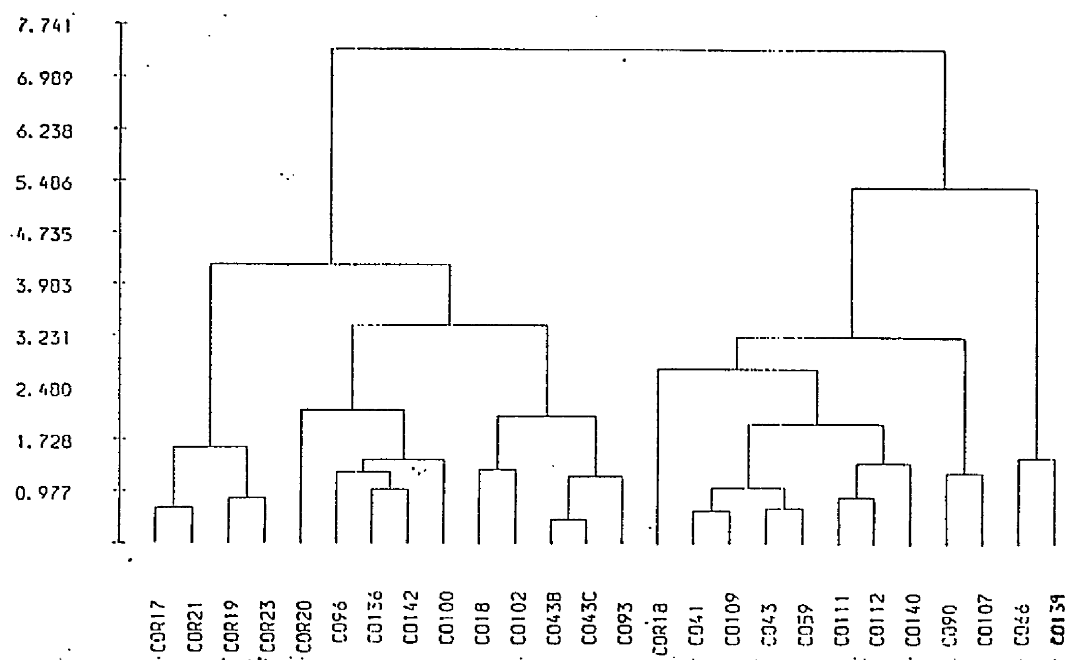
Figure 5.1

Corinth Site Analysis.

Corinth.



Corinth Dilution Corrected.



Dilution was detected using the FACTOR program. This was illustrated by the formation of a single Corinth cluster.(Figure 5.1) The concentration data(Table 5.8) showed a large calcium content, suggesting this dilution was caused by calcium carbonate.

5.3.5 Argos.

All the Argive sherds, which ranged from the Archaic to Hellenistic period, had been analysed before.(BUR86,TOM88) The short-lived isotopes were determined for all twenty sherds, (ARG01-20), while eight samples, (ARG1, 8, 9, 13, 14, 16, 19, 20) were re-irradiated for all elements to compare results.(Section 5.2)

Ward's Method and RELOCATE identified four outliers; a group of three, (ARG07, 11, 18) and ARG10. The group of three had similarly high thorium concentrations, however on further examination they were individual outliers.

Table 5.9

The Argos Group Composition.

Element	Mean	SD	%
Na%	0.716	0.10	14.11
Al%	8.82	0.39	4.40
K%	2.59	0.37	14.19
Ca%	4.67	1.25	26.72
Sc	19.9	1.01	5.05
Ti%	0.486	0.05	10.49
V	118	14.4	12.22
Cr	248	27.6	11.11
Mn	1248	146	11.74
Fe%	5.20	0.35	6.78
Rb	130	14.6	11.24
Cs	6.59	0.85	12.93
La	39.4	4.22	10.72
Ce	76.7	7.04	9.17
Dy	5.92	0.51	8.64
Lu	0.458	0.04	8.92
Hf	5.48	0.45	8.29
Th	12.9	0.99	7.64
U	3.35	0.28	8.46

After the removal of these outliers, two close groups and three additional outliers, (ARG20 and a pair, ARG3 and 4), were identified. The two groups merged after dilution corrections, which also re-defined the three outliers and highlighted another pair, ARG12, 13. Correlation was also evident between Sc and Fe.

These results give a confused picture of Argive pottery production. One group was established; ARG1, 2, 5, 6, 8, 9, 14-17, 19.[Table 5.9] This was seen after dilution corrections, suggesting the presence of a diluent. Unfortunately a large number of outliers were identified. Hopefully site comparisons will explain these anomalies.

The previous analyses[BUR86, TOM88] had identified five outliers, (ARG7, 10, 11, 18 and 20), and two close groups. The present study clarified these results, producing a single group after dilution corrections. The addition of the short-lived elements did identify four sherds, (ARG3, 4, 12, 13), previously thought to be Argive, as non-Argive.

5.3.6 Sparta.

Twenty-five Spartan Black Glaze sherds, (SP16,18,24, 27-37, 39-50) were included from an earlier project.[FOY90] Eight of these sherds were re-examined in this project.

Cluster analysis identified five outliers, (SP18, 31, 32, 34, 43), due to anomalous concentrations for individual elements. Two additional sherds, (SP28 and 30), formed an outlying pair, because of low Mn concentrations. After the removal of the outliers, two groups were created.

GP 1: SP16, 27, 32, 36-42, 44, 48, 50.

GP 2: SP24, 29, 33, 35, 45, 47, 49.

Table 5.10

The Composition of the Spartan Groups.

Sparta Group One.

Element	Mean	SD	%
Na	0.364	0.07	9.25
Al	10.0	0.52	5.23
K	1.52	0.50	33.46
Ca	3.85	0.83	21.26
Sc	21.9	1.86	8.47
Ti	0.576	0.02	3.94
V	98.3	20.2	20.60
Cr	266	49.8	18.72
Mn	1128	212	18.85
Fe	6.21	0.26	4.27
Rb	42.7	9.35	21.90
Cs	1.23	0.51	41.62
La	47.5	2.93	6.17
Ce	92.9	4.63	4.99
Dy	6.51	0.97	14.95
Lu	0.573	0.01	3.37
Hf	6.78	0.46	6.91
Th	16.8	1.06	6.35
U	4.21	1.18	28.23

Sparta Group Two.

Element	Mean	SD	%
Na%	0.289	0.05	17.16
Al%	11.52	1.32	11.49
K%	1.25	0.39	31.54
Ca%	2.59	0.84	32.35
Sc	20.3	2.15	10.56
Ti%	0.704	0.05	7.11
V	103	22.0	21.20
Cr	172	23.6	13.71
Mn	962	107	11.19
Fe%	6.69	0.71	10.59
Rb	44.3	15.0	33.87
Cs	1.73	0.55	31.87
La	61.8	7.16	11.59
Ce	119	12.3	10.30
Dy	7.85	0.56	7.14
Lu	0.638	0.04	6.10
Hf	8.61	0.54	6.34
Th	20.3	2.41	11.90
U	4.81	0.91	19.03

Means and standard deviations of the Spartan groups(Table 5.10) show the disparity of the two groups. Both groups had large Ce and Th concentrations and very low Rb and Cs concentrations. However, Group 1 was distinguishable by high Cr and Mn.

5.3.7 Elis.

Twenty Black Glaze sherds from Elis, (ELI01-20) had been analysed previously,(TOM88) resulting in the identification of two similar groups. Nine sherds, (ELI1, 3, 4, 7, 10, 12, 13, 15, 19) were re-irradiated for this project.

Cluster analysis produced five outliers, (ELI01-3, 5, 18). Once these had been removed a single cluster was produced. No dilution effects were seen, however a correlation between Rb and Cs was identified.(Figure 5.2) This is due to the presence of a feldspar, a type of mineral which is rich in both Rb and Cs.

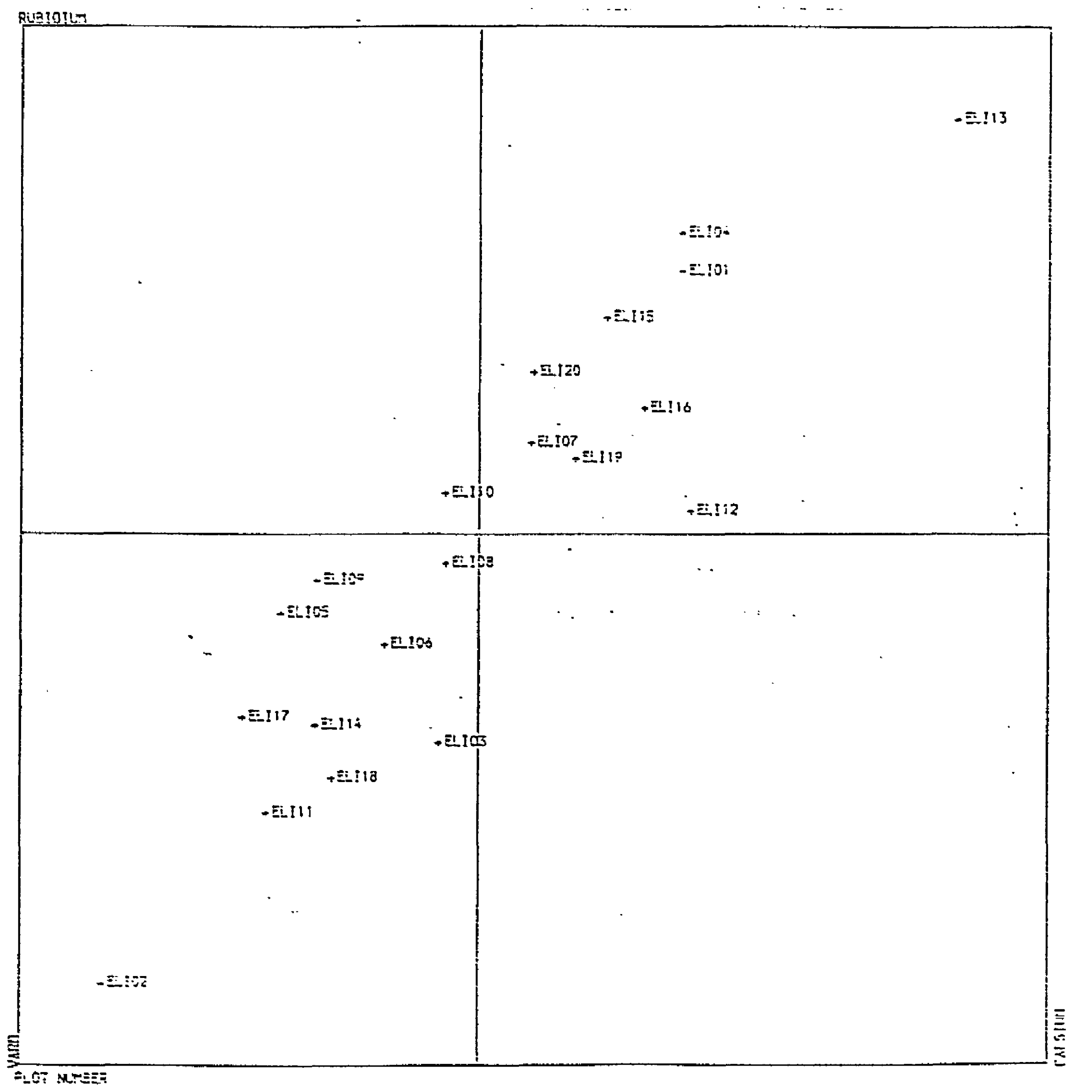
Table 5.11

The Elis Group Composition.

Element	Mean	SD	%
Na%	0.896	0.05	6.04
Al%	8.12	0.29	3.65
K%	1.75	0.34	19.81
Ca%	5.25	0.53	10.08
Sc	21.5	0.64	3.01
Ti%	0.469	0.03	7.53
V	104	8.17	7.83
Cr	327	41.4	12.67
Mn	1086	59.6	5.49
Fe%	5.67	0.13	2.42
Rb	108	20.6	18.92
Cs	4.76	0.92	19.46
La	31.9	1.53	4.82
Ce	63.8	2.89	4.53
Dy	4.99	0.42	8.51
Lu	0.418	0.02	5.12
Hf	4.48	0.40	8.97
Th	11.7	0.35	3.05
U	2.08	0.19	9.60

Figure 5.2

Elis Correlation (Rb/Cs).



5.4 Comparison of sites.

Once outliers and any sub-structure within a site had been established, the relationships between different sites need to be examined. Comparisons were run on a one to one basis using Ward's Method and RELOCATE.

Of the eight sites analysed both Elis and Sparta were isolated from all the other sites. Three Argos outliers were identified as imports, ARG20 was Attic, and ARG3, 4 associated with Corinth. Some of the other outliers did appear similar to Sparta because of high Th. However the rubidium concentrations of the outliers were large, and they were left unassigned. The remaining Argive sherds formed a distinct group, suggesting local production. Another two outliers, ARG12 and 13, had unusually high manganese concentrations, by omitting Mn from the analysis these sherds were identified as members of the Argos site group.(Table 5.9)

Table 5.12

The Composition of Akraiphnion Group 2.

Element	Mean	SD	%
Na%	0.303	0.05	17.39
Al%	8.69	0.25	2.93
K%	1.37	0.33	24.08
Ca%	5.56	0.49	8.92
Sc	24.7	1.33	5.36
Ti%	0.501	0.04	9.09
V	132	14.5	11.00
Cr	435	28.0	6.43
Mn	911	80.2	8.81
Fe%	6.69	0.40	5.96
Rb	77.4	22.6	29.22
Cs	3.83	1.00	26.15
La	31.8	0.87	2.73
Ce	65.8	5.29	8.04
Dy	4.21	0.51	12.19
Lu	0.390	0.12	29.87
Hf	3.56	0.34	9.73
Th	11.1	0.61	5.44
U	2.47	0.57	23.01

The analysis of sherds from Akraiphnion had produced two groups. One of these, Group 2, was separate from all the other sites, hence a possible local site group.(Table 5.12) The other group, Group 1, associated with Chalkis. This and other associations are discussed below.

5.4.1 Athens.

The Athenian sherds, after outliers had been removed, formed a homogeneous group. Comparison with the Black Glaze sherds from Chalkis showed that the outlying Chalkis group, (C4, 41, 45, 56), was Attic. Another outlier of the Chalkis analysis, C47, had an unusually high Cs content, by omitting Cs from the analysis C47 was also identified as Attic. The bulk of the Tanagra sherds associated with the Athenian group. By calculating the means and standard deviations for these three groups, a compositional pattern can be seen. Figure 5.3 suggests that the Chalkis sherds and Tanagra sherds are Athenian, and that Attic ware is characterised by high Cr and Cs.

5.4.2 Euboea.

Initial comparison between the Black Glaze sherds from Eretria and Chalkis produced three groups, one of which has been identified as Athenian.

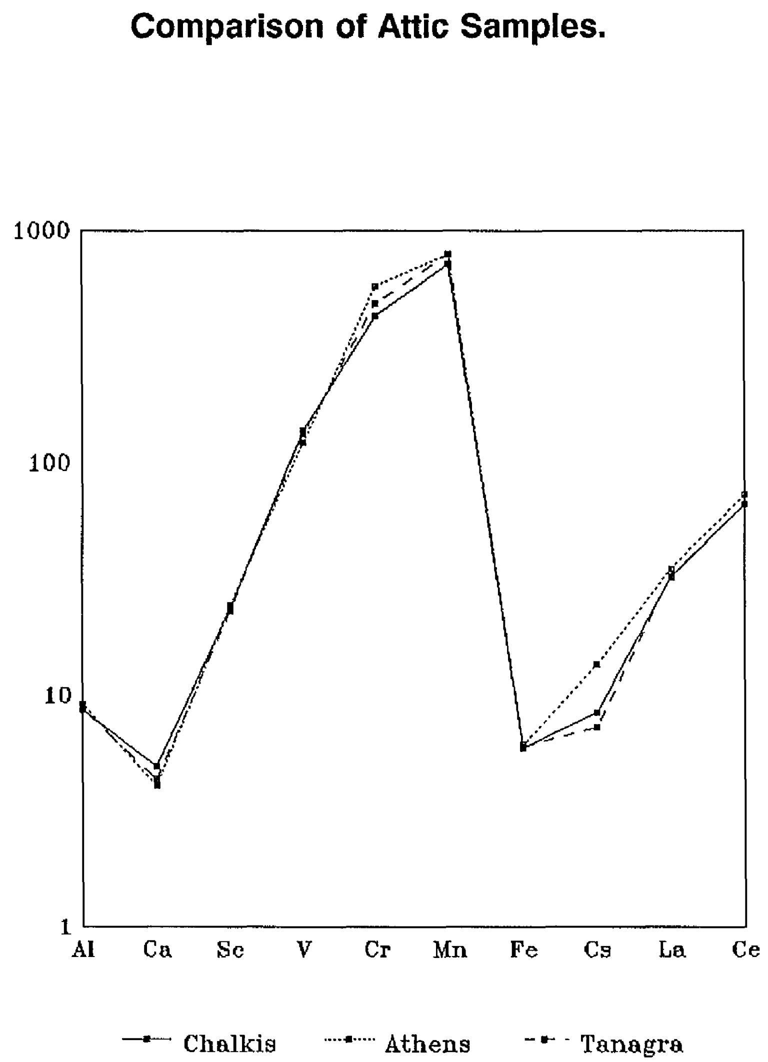
GP 1: C04, 41, 45, 56. Athenian.

GP 2: E06, 10, 12, 15, 17.

GP 3: Rest of Eretrian and Chalkis sherds.

The addition of the Late Geometric sherds distorted the results. Again, the Athenian group was isolated. The remaining sherds formed two close clusters, both

Figure 5.3


Comparison of Attic Samples.
1000
100
10
1
Al
Ca
Sc
V
Cr
Mn
Fe
Cs
La
Ce
Chalkis
Athens
Tanagra

containing a mixture of Eretrian and Chalkian samples. To establish the "closeness" of these two clusters, the means and standard deviations of one cluster (EUBA) and the original Chalkis Black Glaze group, which was very similar to the other cluster, were calculated. These were compared with all the Euboean data using MAHALA.

Table 5.13 shows a selection of Mahala output. Samples C1, 2 and CH15 were all members of EUBA, but were assigned to the Chalkis group. The results show that the Euboean subgroups were very similar, as all samples were close to each group, therefore suggesting a single group for Euboea.(Appendix 4:D1) One anomaly was seen for three Eretria sherds, E6, 10, 12. They appeared as outliers during site analysis, and remained so after the addition of the Geometric sherds.

Table 5.13

Euboean Data: MAHALA Output.

SAMPLE	BEST GROUP	EUBA	CHALKIS
C01	CHALKIS	18.17 12 2	13.51 14 1
C02	CHALKIS	12.35 15 1	8.48 17 0
C5	EUBA	13.93 14 0	14.61 11 0
E09	EUBA	12.37 14 0	13.11 14 1
CH02	EUBA	16.19 12 2	17.70 12 1
CH15	CHALKIS	10.48 17 0	10.33 15 0

As a result of comparing the Euboean sites of Eretria and Chalkis, no separation of the two individual sites was possible. This could of been due to the presence of a Sc/Fe correlation. However, the range of the concentrations was the same for the two sites,(Figure 5.4) affirming the likelihood of a single "Central Euboean" clay source. The mean and standard deviations for this "Central Euboean" source were calculated(Table 5.14) and included in the database to identify other Euboean sherds.

Figure 5.4

Euboean Correlation (Sc/Fe).

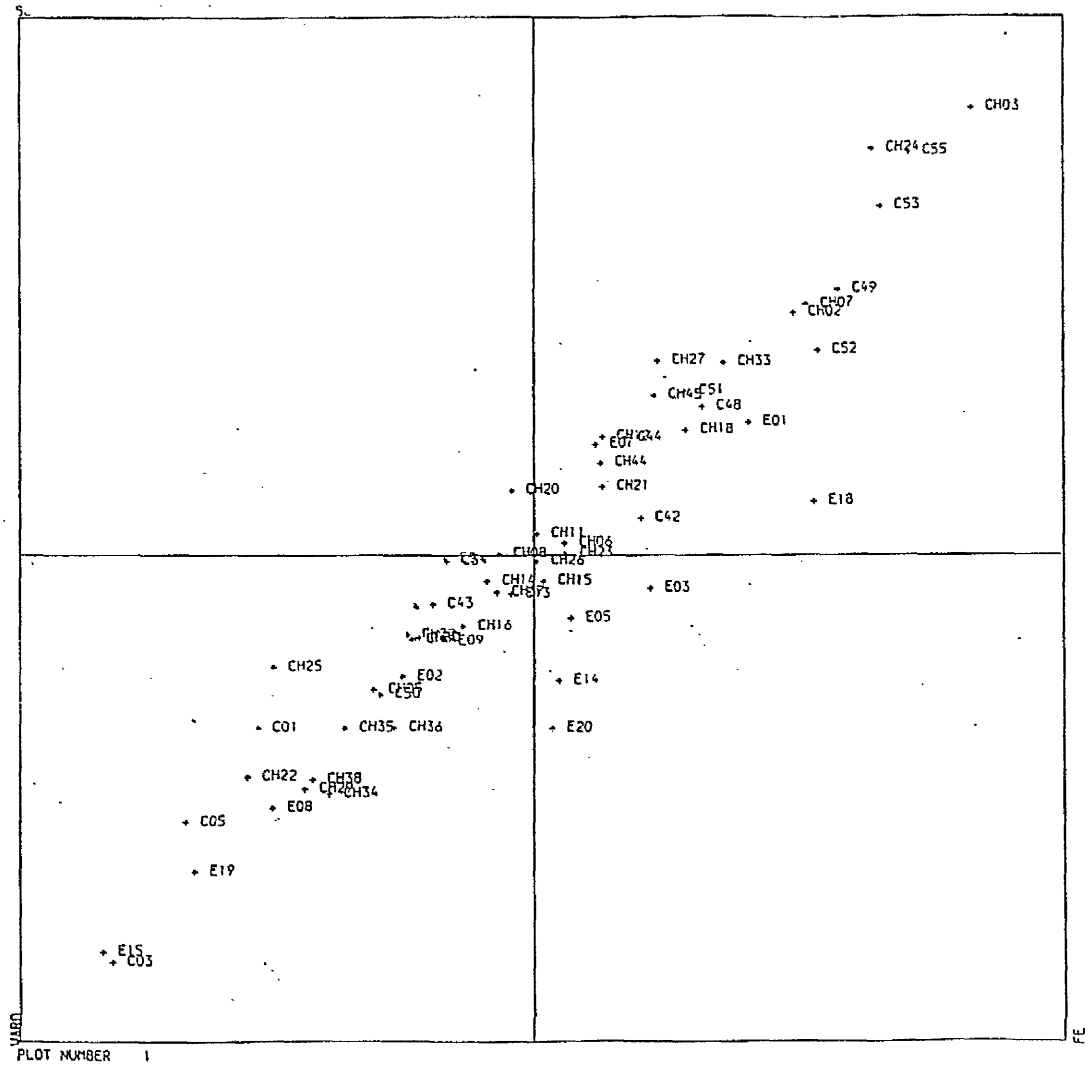


Table 5.14

The Central Euboean Source.

Element	Mean	SD	%
Na%	0.951	0.15	15.70
Al%	10.6	0.67	6.32
K%	3.67	0.51	13.99
Ca%	3.34	0.71	21.35
Sc	23.4	1.95	8.32
Ti%	0.482	0.05	10.18
V	123	10.7	8.69
Cr	182	20.5	11.27
Mn	947	82.1	8.67
Fe%	5.66	0.47	8.44
Rb	159	16.8	10.50
Cs	9.8	1.15	11.72
La	38.5	2.44	6.34
Ce	77.6	5.28	6.80
Dy	5.35	0.51	9.61
Lu	0.431	0.06	14.68
Hf	4.09	0.77	19.04
Th	14.6	1.09	7.46
U	3.44	0.93	27.27

5.5 Discussion.

From the nine sites investigated seven distinctive fabrics have been established for Akraiphnion, Argos, Athens, Corinth, Elis, Sparta, and the island of Euboea, (summarised in Appendix 3). By calculating the means and standard deviations for these seven groups, the elements which distinguish each site can be identified.(Tables 5.15)

Comparing the distinctive fabrics and therefore the likely production sites has produced evidence of trade between mainland sites. Argos appears to have been a metropolitan city, having imported pottery from Corinth and Athens, as well as producing its own.

The majority of the Tanagra sherds affiliated with Athens. Athens is a known exporter of pottery and it is not surprising it supplied Tanagra, especially as Tanagra was situated on the Attic/Boeotian border. Attic pottery was also found at Chalkis and Argos. Tanagra did not get all its Black Glaze from Athens. The outlier TAN09 was found to be Euboean. Euboean pottery was also found at Akraiphnion, suggesting the Euboean sites exported to sites throughout Boeotia. As these two regions are close, it is not surprising that pottery from one was found at the other.

Elian pottery was only found at Elis. This is consistent with the isolationist policy adopted by Elis. Similarly Spartan pottery was isolated, though three sherds from Argos displayed similarities with Sparta Group 1. This was due to high Ce and Th concentrations, which appears to be a characteristic of Laconian pottery. These were dismissed by discrepancies in the Rb and Cs concentrations, (the Spartan sherds have extremely low concentrations of these elements).

Table 5.15

Group Characteristics

Site.	**Distinguishable Elements.**
Akraiphnion	High Cs. Low Na, Rb.
Argos	High Mn.
Athens	High Cr, Cs. Low Mn.
Corinth	High Ca.
Euboea	High Al, Cs. Low Cr.
Elis	Low Rb.
Sparta 1	Low Rb. High Th.
Sparta 2	Low Rb. High Th, Mn.

Having established a database of seven mainland production sites, particular areas of study can be investigated. Multivariate analysis now began with MAHALA.

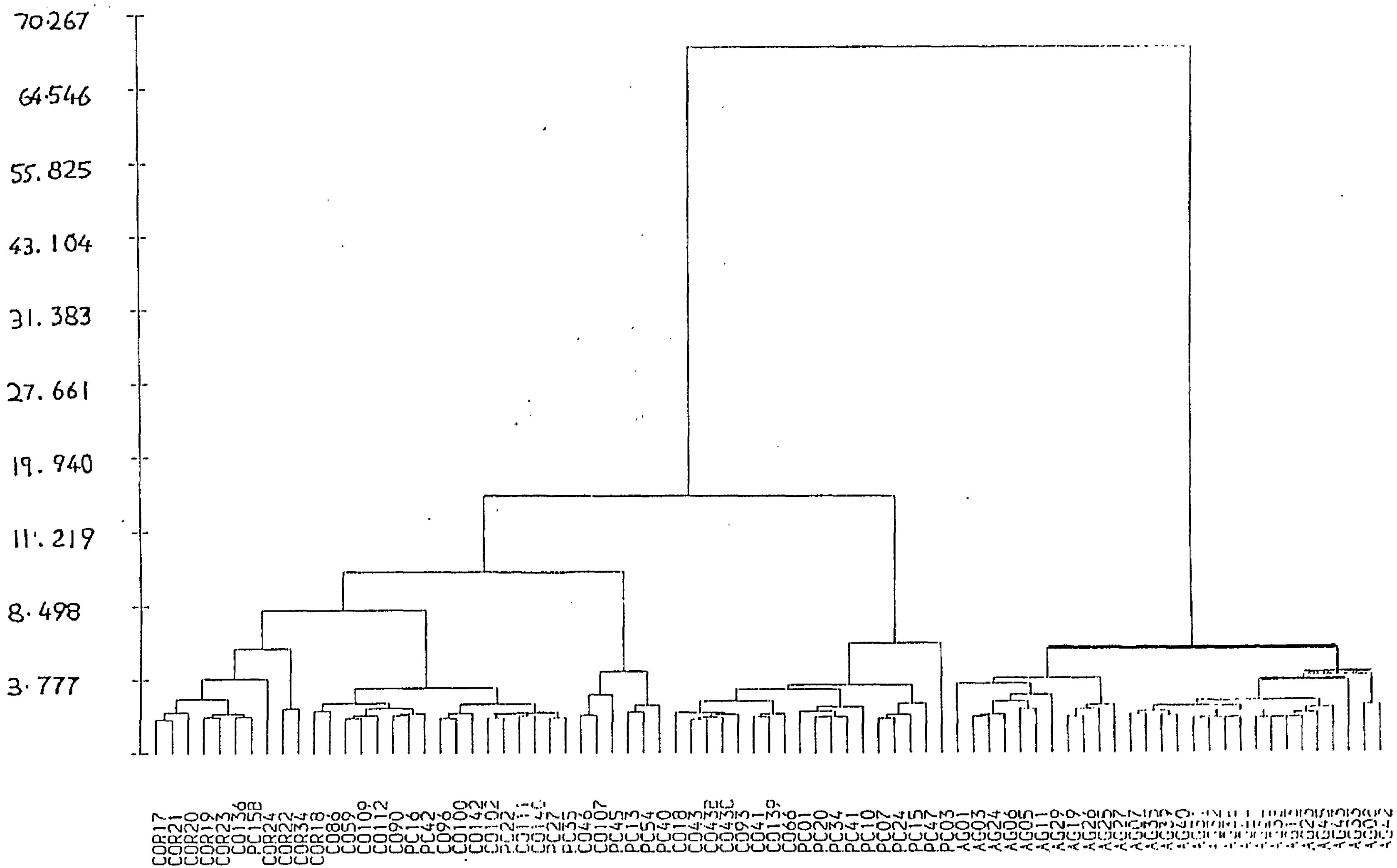
This was used to identify any similarities between new samples and the defined sites. Cluster analysis was then used to clarify the results.

5.6 Peracliora.

Nineteen Protocorinthian sherds from Perachora, (PC), were sampled at Museum of Classical Archaeology, Cambridge. Perachora was a small site with a major sanctuary on a peninsula in the Gulf of Corinth. As Corinth was the dominant city in the area, all the Perachora sherds were expected to be from there. However, MAHALA gave six unassigned samples, (PC1, 3, 13, 40, 47, 54), and suggested a split between Corinth and Athens. This is really unlikely as the two sites were rivals and were not likely to be trading.

Looking at Perachora and Corinth together, three clusters were seen. One Corinthian Black Glaze, and two consisting of a mixture of Perachora and Corinthian sherds. These latter clusters were identical to those seen by MAHALA, which associated with Corinth and Athens respectively. Repeating cluster analysis after dilution corrections, highlighted four Perachora outliers, (PC3,13,40,54). After the removal of these outliers, two close groups containing a mixture of Corinthian and Perachora sherds were seen. This suggests a dilution effect, possibly due to the large calcium content of these sherds.

As MAHALA had suggested an Attic similarity, Corinth, Perachora and Athens were analysed together. Two separate groups were produced, one containing Athens, the other Corinth and Perachora.(Dendrogram 5.1) Hence the Perachora sherds were not Athenian, and any similarities had been caused by dilution effects. Therefore, as expected Corinth supplied Perachora with pottery.



Dendrogram 5.1 Peracora, (PC), Corinth, (CO) and Athens, (AG).

5.7 The Argolid.

The analysis of twenty Black Glaze sherds from Argos gave an unclear picture of Argive pottery production. It was therefore decided to concentrate on this region, in order to resolve this problem. In doing so the number of sites under investigation was increased to include Mycenae, Berbati, the Argive Heraeum, Tiryns, Asine and Halieis, and an additional pottery style, Argive Geometric, was introduced, extending the period covered back to the eighth century BC.

5.7.1 Mycenae.

Two sets of sherds were analysed from Mycenae. These included 29 Geometric and Black Glaze sherds, (MY3-18, 30-44), sampled at Museum of Classical Archaeology, Cambridge, and 18 Black Glaze sherds, (MYC1, 2, 5-12, 14-20), supplied by the British School at Athens and collected at Nauplion.

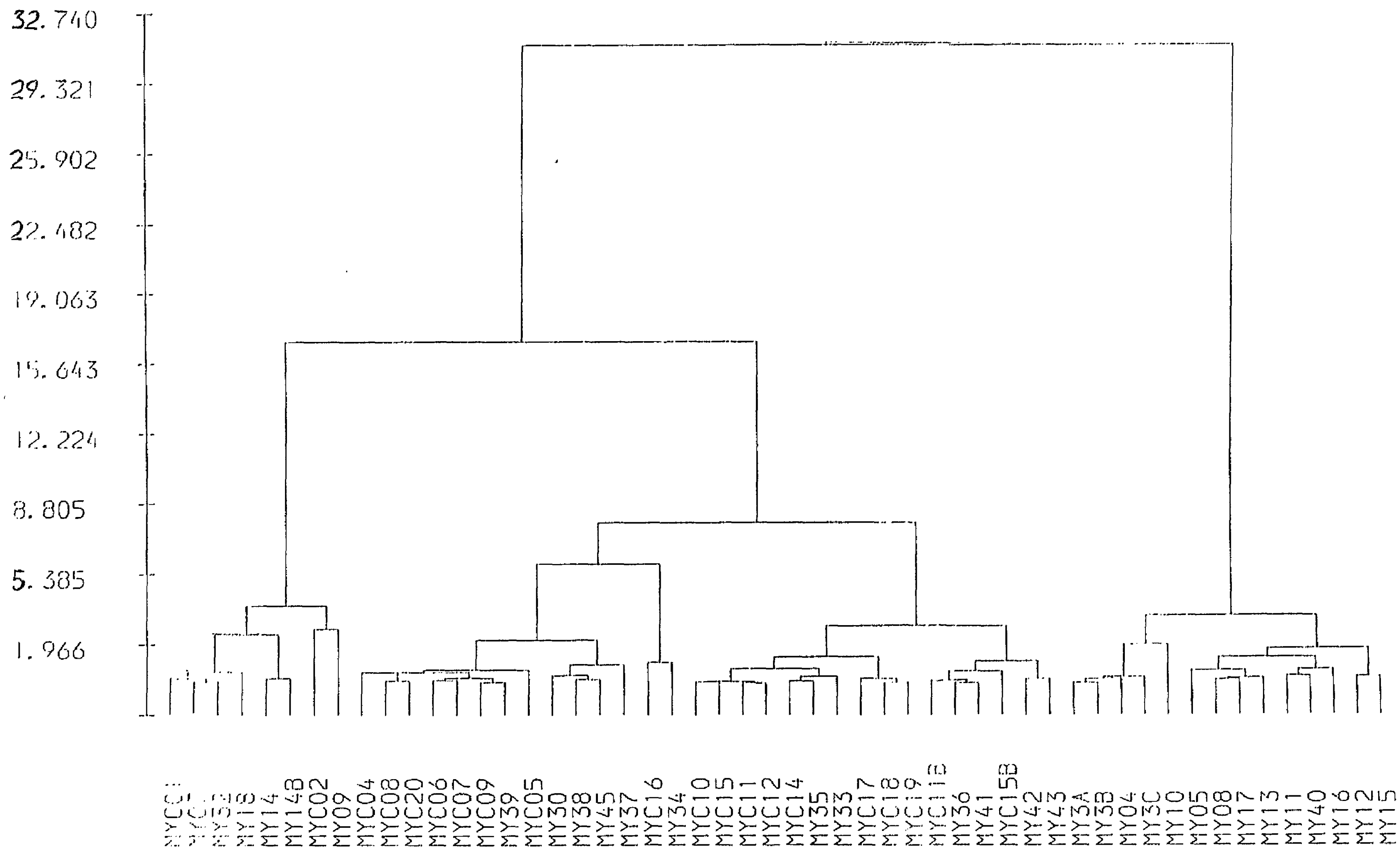
Cluster analysis identified a number of outliers, (MY7, 9, 12, 14, 15, 32, 34, MYC1, 2, 16). On removal of the outliers two groups were seen.(Dendrogram 5.2)

1: MY3-5, 8, 11, 13, 16, 17, 40.

2: MY30, 33, 35-39, 41-44, MYC4-15, 17-20.

Group 2 was distinguishable from Group 1 by a high Mn concentration, suggesting a similarity to the Argos site group. Group 1 had a high Ca content implying a Corinthian origin. However, Group 1 and the Corinth site group were separated by low V and Rb values. The FACTOR program gave the same results, hence no dilution effects were involved.

The archaeological information described the members of Group 1 as Argive Geometric, while Group 2 consisted of Black Glaze ware. This leads to the conclusion



Dendrgram 5.2 Mycenae (Black Glaze and Argive Geometric).

that the two styles are compositionally different, suggesting either different sources of clay or methods of manufacture.

To check the similarity of this "new" group, the means and standard deviations of Group 1 were calculated and compared with the other site groups using MAHALA. The results gave Group 1 as an isolated group. This was then included in the database for all further analyses, under the name of Argive Geometric.(Table 5.16)

Table 5.16

Argive Geometric.

Element	Mean	SD	%
Na%	0.948	0.09	9.76
Al%	7.68	0.36	4.78
K%	1.97	0.40	20.73
Ca%	9.16	1.23	13.41
Sc	19.2	1.20	6.27
Ti%	0.458	0.04	9.76
V	98.0	7.15	7.30
Cr	208	16.5	7.93
Mn	978	73.1	7.47
Fe%	4.95	0.29	5.97
Rb	102	9.92	9.71
Cs	5.65	0.65	11.63
La	30.2	1.98	6.57
Ce	62.8	4.70	7.49
Dy	4.32	0.36	8.35
Lu	0.380	0.06	18.07
Hf	4.57	0.34	7.56
Th	10.9	0.69	6.36
U	3.60	0.36	10.07

MAHALA associated the Black Glaze group, Group 2, with the Argos site group, confirming the earlier observation. Mycenae was a powerful city during the Bronze Age, but was destroyed in the eleventh century. A small settlement grew on its citadel in the Early Bronze Age, and conditions improved by the seventh century BC. It lay within the Argive sphere of influence, but could act independently, and was destroyed by Argos in 468BC. After 300BC the Argives re-established it as a township, rebuilt the walls, and erected new buildings, but it never flourished again. Hence the presence of Argive pottery at Mycenae is not surprising. However, as the two sites were close, it is possible, though unlikely, both sites produced pottery and their clay beds were too similar to be distinguished.

The majority of the outlying sherds were assigned to other site groups, hence explaining their outlying nature. Five, (MY7, 12, 15, 32, MYC1), were found to be Corinthian, one, (MYC2), was Athenian, and two, (MY34, MYC16), appeared to be Spartan, due to high Th concentrations. On further analysis MYC16 was separable from both Spartan groups, while MY34 was a member of Sparta Group 1, (SP1).

Table 5.17

MAHALA output for Mycenae outliers.

SAMPLE	BEST GP	ATHENS			CORINTH			SP1		
MY07	CORINTH	34.81	6	5	17.69	13	1	65.76	6	10
MY09	ATHENS	36.39	12	5	49.23	6	5	110.23	5	11
MY12	CORINTH	46.64	6	7	20.13	10	2	66.58	6	12
MY14	ATHENS	34.47	7	7	34.52	6	8	72.21	5	12
MY15	CORINTH	53.12	5	9	15.51	13	0	70.07	7	12
MY32	CORINTH	34.78	7	4	11.60	15	0	69.34	4	10
MY34	SP1	62.95	2	11	58.52	5	11	33.70	10	2
MYC01	CORINTH	39.39	6	8	17.92	10	0	73.19	6	11
MYC02	ATHENS	16.71	15	1	54.60	5	9	75.10	3	10
MYC16	SP1	64.46	5	10	69.61	5	11	42.60	9	7

5.7.2 Berbati.

The northern Argive site of Berbati is a known producer of Bronze Age pottery, (kilns have been excavated). Like other Bronze Age sites, Berbati declined during the Archaic period and came under Argive rule. The samples analysed from this site included Classical, Hellenistic, (B2, 3, 5-21, 26-42), and Archaic, (BA01-4, 6-8, 10-19) Black Glaze sherds supplied by the Swedish School at Athens, (Berbati excavations).

Site analysis identified three outliers, B6, B13, B34. Removing these gave two diffuse groups, one containing the majority of the Classical and Hellenistic sherds, the other a mixture of some Classical and Hellenistic, and the bulk of the Archaic sherds.(Appendix 4:D2) FACTOR showed a greater separation between the two clusters, with the Archaic group becoming more compact. This suggested a possible dilution of the latter cluster.

Analysis continued by separating the two clusters, beginning with the Classical and Hellenistic cluster. Three outliers were seen, (B42, 37, 41), the latter two had high calcium contents suggesting a possible Corinthian origin. On the removal of these outliers the following groups were identified.

1: B2, 3, 5, 9, 16, 17-20, 26, 31, 32, 35, 36, 38-40, BA7

2: B7, 8, 10, 14, 21, 33, BA8

To clarify the closeness of these groups, Group 1 was defined for MAHALA. All of Group 2 except BA8 (due to very high Mn concentration, therefore a slight outlier of the group) were identified as members of Group 1. Hence the Classical and Hellenistic cluster was one group.

The second cluster, containing the majority of the Archaic sherds, had one outlier, (BA3, due to an extremely high Ca concentration, suggesting it was a slight outlier of the group)). After BA3 was removed two groups were produced. The FACTOR result for the total data set showed the Archaic sherds were most distorted, suggesting dilution. Therefore, FACTOR was rerun to see if the substructure of this cluster was real. BA15 was a major outlier due to an anomalous Rb concentration. On its removal, the sherds appeared as one group, showing a dilution effect. Thus the sherds were treated as a group.

Slight similarities with Argos, Corinth and Argive Geometric were seen when the Berbati sherds were compared with known Greek production sites.(Table 5.18) Two of the outliers (B13, 34) were similar to Sparta, but as with previous samples their Rb content was too large and they were left unassigned.

Cluster analysis with Argos, Corinth and Argive Geometric produced two groups. The Classical and Hellenistic cluster with Argos and the Archaic cluster with Corinth and Argive Geometric.

The relationship between the Archaic cluster, Corinth and Argive Geometric was, possibly, caused by dilution effects.(Appendix 4:D3) FACTOR showed no change in groupings, two distinct groups were formed, one of possible Corinthian origin, the other of Geometric pottery.

1: B11, 28, 37, 41, BA2, 4, 6, 10, 11, 13, 17, 19, Corinth.

2: B27, 29, 30, BA1, 12, 14, 16, 18, Argive Geometric.

Turning to the Classical and Hellenistic cluster, all the sherds except known outliers grouped with Argos, suggesting a potential production site.

Finally the means and standard deviations of the three Berbati groups were calculated and used in conjunction with MAHALA. The Argive Geometric sherds associated with the Berbati Geometric group, the Corinth sherds with the Berbati Corinthian group and the Argos sherds with the Classical and Hellenistic cluster, confirming our results.

The archaeological information(PEN93) suggested that the Classical and Hellenistic sherds were local. Chemical analysis gave the majority of these as Argive. Berbati and Argos are both on the Argive Plain, so Argos could easily have supplied pottery to Berbati. However as the sites are close the clay sources maybe too similar

Table 5.18

Berbati Provenance by MAHALA.

Sherd	Group	ARG			COR			AG		
B02	ARG	12.91	13	0	25.49	9	6	23.95	8	3
B03	ARG	12.92	14	1	41.93	5	9	35.21	6	7
B05	ARG	13.62	13	0	39.69	2	8	36.64	4	6
B06	ARG	40.84	4	5	59.73	3	13	45.57	6	9
B07	ARG	18.70	10	3	37.49	7	7	45.03	4	7
B08	ARG	23.24	10	5	30.51	8	4	34.93	5	7
B09	ARG	23.83	8	3	50.90	4	12	50.11	3	12
B10	ARG	18.61	14	3	33.52	7	5	36.25	6	5
B11	COR	50.11	3	9	15.28	13	2	29.80	9	4
B12	AG	48.29	2	10	28.16	7	6	23.46	11	6
B13	ARG	55.33	8	10	76.15	4	12	74.88	3	12
B14	ARG	20.80	9	3	34.58	8	9	43.53	3	11
B15	COR	52.50	5	11	26.40	7	4	30.33	9	7
B16	ARG	15.85	12	2	30.51	8	5	25.06	9	5
B17	ARG	10.13	17	0	34.54	6	5	33.38	8	8
B18	AG	25.48	8	6	30.03	9	6	23.90	8	4
B19	ARG	12.08	15	0	40.71	5	7	35.30	5	6
B20	ARG	15.73	12	0	43.86	4	9	45.85	2	8
B21	ARG	29.94	7	6	43.72	3	8	54.16	2	14
B26	ARG	11.66	16	0	30.00	9	6	33.30	7	6
B27	AG	28.68	8	5	24.87	8	3	15.97	12	0
B28	COR	57.05	5	11	31.17	3	5	26.67	9	5
B29	AG	30.84	9	6	28.71	10	6	13.42	15	0
B30	AG	58.18	2	10	40.58	6	9	22.36	7	1
B31	ARG	24.16	8	3	38.72	5	7	31.99	10	6
B32	ARG	22.06	11	3	46.69	5	12	47.56	5	9
B33	ARG	36.03	4	6	42.22	6	9	55.29	1	12
B34	ARG	56.51	3	13	75.41	4	14	84.46	1	13
B35	ARG	16.92	11	1	31.86	7	6	40.02	3	6
B36	ARG	11.93	14	0	37.04	6	8	39.24	5	7
B37	COR	34.81	8	6	16.68	9	0	32.29	6	7
B38	ARG	18.95	11	2	49.64	4	11	45.02	7	7
B39	ARG	11.92	16	1	30.50	6	6	31.65	9	6
B40	ARG	13.86	14	1	35.29	6	7	37.22	7	8
B41	COR	28.67	10	7	17.62	11	3	29.04	8	8
B42	COR	65.35	5	9	62.79	3	13	67.26	2	16
BA1	AG	40.64	6	7	26.80	9	4	8.35	16	0
BA2	COR	39.75	6	9	17.31	9	5	20.49	10	3
BA3	COR	65.38	4	11	28.21	7	5	32.75	9	4
BA4	COR	52.35	2	12	15.75	12	1	24.93	9	6
BA6	AG	51.67	4	10	27.87	8	3	23.29	7	4
BA7	ARG	16.28	10	0	33.33	9	8	27.17	9	4
BA8	ARG	34.05	7	8	45.94	5	8	58.27	3	13
BA10	COR	48.90	3	9	18.76	13	2	35.46	4	8
BA11	COR	50.53	4	10	12.35	15	0	26.75	8	3
BA12	AG	55.95	2	10	34.94	5	6	14.77	13	0
BA13	COR	42.79	5	8	13.00	16	0	22.44	11	3
BA14	AG	47.67	3	9	31.41	6	7	10.07	18	0

Table 5.18 cont.

Sherd	Group	ARG			COR			AG		
BA15	COR	51.39	6	9	33.85	9	6	40.07	7	8
BA16	AG	25.35	7	3	27.77	10	6	19.86	7	2
BA17	COR	40.37	5	9	12.38	17	0	23.11	10	4
BA18	AG	30.89	10	6	28.73	7	6	18.13	10	0
BA19	COR	48.66	7	10	30.97	7	2	37.59	3	7

Key: **B:** Classical and Hellenistic sherds from Berbati
BA: Archaic sherds from Berbati
ARG: The Argive Black Glaze Group
COR: The Corinthian Group
AG: The Argive Geometric Group

to be distinguishable. Five of the Classical and Hellenistic sherds were identified as Corinthian, (B12, 15, 28, 37, 41). Of these one, B28, was a common shape, (louterion), believed to be exported from Corinth all over Greece.[(PEN93)] Two samples, (B13, 34), were similar to the Spartan pottery, except for high Rb and Cs. One of these, B13, had been described as Laconian, however the database needs to be expanded before an actual Laconian source can be identified.

The archaeological data for the Archaic sherds proposed a mixture of Argive and Corinthian pottery.[(ERT93)] Five sherds, (BA4, 6, 10, 11, 13), were confirmed as Corinthian, along with three sherds, (BA2, 17, 19), which had been given as Argive. Of the remaining Archaic sherds, BA1, 16, 18 were verified as Argive Geometric, while BA12 and 14 were dismissed as Corinthian. Finally BA7 was a member of the Classical and Hellenistic cluster, and therefore an Argive Black Glaze sherd.

5.7.3 Argive Heraeum.

The Argive Heraeum was close to Mycenae and Berbati in the north of the Argive Plain. It was dedicated to Hera, whose cult was important both religiously and politically in the Archaic and Classical periods. The site was controlled by Argos, but this was disputed by Mycenae and Sparta.

Fourteen Argive Geometric sherds were analysed from the Argive Heraeum. These included twelve sherds, (BM), collected at the British Museum, and two sherds, (AH1, 2), sampled at Museum of Classical Archaeology, Cambridge.

Table 5.19

Argive Heraeum provenance: MAHALA Output.

Sherd	Group	ARGOS			CORINTH			AG		
BM76	CORINTH	36.95	7	8	25.73	9	5	42.59	3	7
BM83	CORINTH	34.97	6	8	30.00	10	4	38.99	5	10
BM90	CORINTH	29.20	8	4	25.13	7	4	27.54	8	7
BM93	AG	28.27	9	7	31.18	7	6	25.36	11	4
BM95	CORINTH	41.71	5	7	17.14	14	3	38.71	5	7
BM107	CORINTH	30.75	8	6	20.24	11	2	36.57	4	5
BM111	AG	32.23	7	5	24.60	7	4	24.36	10	5
BM115	AG	29.03	8	5	23.00	8	2	18.61	12	2
BM118	CORINTH	33.73	6	7	21.47	11	2	22.99	11	2
BM122	CORINTH	38.37	8	9	22.80	9	4	34.99	9	9
BM239	AG	29.38	6	6	24.53	10	5	21.64	11	4
BM241	ARGOS	23.34	11	3	23.44	10	4	23.47	9	3
AH01	AG	44.74	2	10	25.99	7	4	15.77	13	1
AH02	AG	31.00	7	6	22.58	9	3	15.52	14	3

MAHALA split the sherds between Corinth and Argive Geometric.(Table 5.19) These assignments were close, and included a number of ambigious results, (when a sherd is very similar to two or more groups). The majority of the sherds grouped with the Argive Geometric group during cluster analysis.(Appendix 4:D4) After correcting for dilution using the FACTOR program, all the Argive Heraeum sherds associated with the Argive Geometric, therefore suggesting the initial assignments were due to dilution effects.

The archaeological information described all the sherds as Argive Geometric, with a fabric typical of that from Argos. Chemical analysis has confirmed the potterys' style, however the Argive Geometric group remained separate from the Argive Black Glaze, suggesting different sources of clay.

5.7.4 Argos

An additional three sherds were analysed from the major Argive citadel of Argos, (AR1-3). These were collected at the Museum of Classical Archaeology at

Cambridge, and thought to be Argive Geometric.

Using MAHALA three different sources were identified for the sherds.(Table 5.20) One sherd associated with Argive Black Glaze group, (ARG), another with Argive Geometric pottery, (AG), and the third with pottery from Corinth, (COR).

Table 5.20

The MAHALA assignments for the Argos sherds.

Sherd	Group	ARG			AG			COR		
AR03	AG	33.56	1	9	14.13	15	1	31.49	7	5
AR04	ARG	19.59	11	2	27.14	6	5	33.45	8	6
AR05	COR	30.86	6	7	27.44	8	4	19.69	11	3

Argos has been thought to be the source of Argive Geometric ware. If the three Geometric sherds from Argos had associated with the Argive Black Glaze group, (ARG), it would have suggested a single source at Argos and a different source for the Argive Geometric group. The inclusion of one sherd in each Argive group implies that there were two different sources of clay used by the potters of Argos. However without further evidence, such as kiln sites, no definitive source can be identified.

5.7.5 Tiryns.

Tiryns, in the southern Argolid, close to Argos, was an influential Bronze Age site. It was destroyed in the eleventh century BC, and survivors settled outside its city walls. These settlers were under Argive rule, before being displaced to Halieis in the Classical period. Two sets of sherds were analysed; one set of 4 Geometric sherds, (TI1, 3, 4, 11), sampled at Museum of Classical Archaeology, Cambridge, the other, 41 Classical and Hellenistic Black Glaze sherds, (T1-15), supplied by the German

Institute, (Tiryns excavations), and collected at the Tiryns Storeroom.

Site analysis identified six outliers, (T3/3, 8/2, 12/3, 14/2, 3, 15/2), and an outlying group containing T13/2, 3 and all the Geometric samples. After these had been removed two clusters were created. One group, (T1/2, 4/1, 2, 5/1, 6/2, 7/2, 8/1, 12/2, 15/3), was separable by high Cr and Cs concentrations, suggesting an Athenian origin.

To test the cluster analysis results the Tiryns sherds were compared with the database groups using MAHALA. Group 1 associated with Athens corroborating the distinctive elemental composition of Attic ware. Two samples, (T5/3, 6/1), grouped with the Corinth samples. The high Ca content of these sherds implied their Corinthian origin. The outlying group containing the Geometric samples was identified as Argive Geometric.

Five of the outlying sherds, (T3/3, 9/3, 14/2, 3, 15/2), were assigned to the Spartan groups because of high Ce and Th concentrations. However, as with other possible Spartan sherds the Tiryns sherds were not true members of the Spartan groups. Three of the sherds, T14/2, 3 and 15/2, were very similar suggesting a common origin.[(Table 5.21)]

Finally the majority of the remaining sherds associated wth Argos, but a small group was left unassigned.

1: T1/3, 2/1-3, 3/1, 10/1, 11/1, 3, 12/1, 15/1.

This group was distinguishable from the other groups by low Cr and Mn concentrations.[(Table 5.22)]

Table 5.21

The Spartan-like Group from Tiryns.

Element	Mean	SD	%
Na	0.508	0.02	4.24
Al	10.8	0.25	2.35
K	2.47	0.11	4.53
Ca	3.67	0.08	2.57
Sc	22.1	0.69	3.16
Ti	0.651	0.02	3.41
V	141	1.96	1.38
Cr	143	6.05	4.21
Mn	889	41.2	4.64
Fe	5.82	0.15	2.65
Rb	141	10.4	7.40
Cs	7.34	0.69	9.41
La	63.7	1.51	2.37
Ce	129	6.13	4.76
Dy	7.78	0.48	6.29
Lu	0.586	0.01	2.99
Hf	7.61	0.17	2.24
Th	18.9	0.91	4.83
U	4.56	0.06	1.47

Table 5.22

Composition of Tiryns Group One.

Element	Mean	SD	%
Na	0.733	0.04	5.32
Al	9.21	0.64	7.00
K	2.89	0.29	10.17
Ca	3.88	0.57	14.81
Sc	19.8	1.39	7.02
Ti	0.534	0.02	4.96
V	126	16.1	12.80
Cr	205	14.7	7.18
Mn	462	43.5	9.42
Fe	5.23	0.45	8.59
Rb	142	7.03	4.93
Cs	7.79	0.80	10.25
La	42.8	2.82	6.60
Ce	83.7	3.23	3.86
Dy	5.61	0.21	3.85
Lu	0.466	0.04	8.59
Hf	6.43	0.31	4.86
Th	14.2	0.82	5.77
U	3.41	0.25	7.45

5.7.6 Asine.

Asine lay on the Argolic Gulf, 10km from Tiryns. It had flourished in the Mycenaean and Geometric periods before the acropolis was abandoned until the third century BC. The surrounding area was thought to be inhabited throughout this time.

Two sets of samples were analysed from Asine. These were a set of six Late Geometric sherds, (AS20-25), sampled at Museum of Classical Archaeology, Cambridge, and 41 sherds, (UP1-40, 51), from the Swedish excavations of the acropolis and lower town in 1926. These ranged from Geometric to Hellenistic Black Glaze. Included in these samples were fourteen multiples.

Site analysis produced two clusters and one outlying pair, this turned out to be UP29 and its multiple sample UP46, hence only one outlying sherd was found. Removing the outliers gave the same two clusters. Dilution corrections also produced two clusters of slightly different compositions.

Looking at the Asine samples with MAHALA(Table 5.23) showed all the Cambridge samples, (AS20-25) were similar in composition to the Argive Geometric group, along with four Uppsala sherds, (UP1, 2, 5, 6). Six sherds, (UP9, 10, 13, 14, 17, 37), were assigned to Corinth. The rest of the samples were assigned to either Athens, Argos or the Euboean source.

Cluster analysis of Asine with the five site groups produced four clusters.(Appendix 4:D5)

GP1: UP3, 4, 7, 15, 24, 34, 40.

GP2: UP1, 2, 5, 6, 9, 10, 13, 14, 17, 37, AS20-25.

GP3: UP20, 22, 25-27, 30-33, 35, 36, 38, 51.

GP4: UP8, 11, 12, 16, 18, 19, 21, 23, 28, 39.

Of these groups, Group 2 clustered with both Corinth and Argive Geometric.

Table 5.23

Asine Provenance by MAHALA.

	Gp	ATH			ARG			COR			AG			EUBA		
UP1	AG	52.00	6	10	37.83	5	6	24.98	7	3	23.11	6	3	42.54	6	9
UP2	AG	53.65	6	10	34.29	4	6	24.21	10	4	16.48	11	0	41.01	6	8
UP3	ARG	32.01	10	7	26.23	10	5	34.60	7	8	45.61	5	10	28.98	8	3
UP4	ARG	34.50	9	6	19.67	10	2	32.73	5	5	36.29	7	7	29.23	6	5
UP5	AG	48.31	5	9	28.91	6	5	23.69	8	4	13.04	13	0	37.25	8	9
UP6	AG	57.48	1	11	37.11	2	9	25.27	9	5	9.39	19	0	43.88	5	11
UP7	ARG	31.15	10	6	21.75	11	3	30.98	9	7	44.33	7	9	24.73	9	3
UP8	ATH	27.32	7	5	58.78	6	9	50.88	8	4	81.33	6	10	69.41	5	10
UP9	COR	39.15	7	7	35.40	4	7	13.14	15	1	36.19	5	7	40.35	8	7
UP10	COR	38.67	6	6	27.33	9	4	16.26	13	1	39.55	5	9	39.78	7	6
UP11	ATH	15.83	13	2	50.83	6	8	55.17	5	7	87.50	1	14	46.95	11	6
UP12	ATH	28.42	10	6	38.50	5	8	29.97	5	6	63.39	5	12	38.18	7	6
UP13	COR	48.38	3	12	36.06	9	7	17.58	11	0	40.21	6	9	53.13	4	9
UP14	COR	39.64	3	12	35.84	6	5	10.96	15	0	43.61	4	8	40.88	8	8
UP15	ARG	34.02	7	6	25.79	9	3	34.95	7	8	45.53	4	10	31.90	7	5
UP16	ATH	17.53	13	2	51.00	7	8	59.28	6	12	96.56	1	16	47.86	8	5
UP17	COR	35.93	10	5	33.36	6	5	19.02	13	2	43.08	4	12	37.39	8	4
UP18	ATH	15.76	11	1	44.86	7	6	47.39	7	9	78.96	4	13	39.08	9	3
UP19	ATH	19.78	11	4	62.29	9	7	56.40	7	9	99.05	2	15	55.53	10	4
UP20	ARG	37.16	8	5	23.06	7	2	38.16	8	10	63.66	3	16	37.51	9	5
UP21	ATH	33.31	4	7	43.18	4	7	37.90	4	12	71.90	5	12	41.67	3	7
UP22	ARG	45.28	7	10	29.17	9	7	49.95	6	9	76.89	2	16	43.67	9	6
UP23	COR	30.49	8	4	35.62	7	6	23.30	8	3	56.65	6	12	32.70	10	5
UP24	EUBA	44.37	6	9	35.14	8	8	53.03	5	9	69.59	4	14	28.56	12	3
UP25	ARG	46.32	4	9	18.82	12	3	37.91	7	8	47.19	6	10	34.63	8	4
UP26	ARG	49.47	7	10	19.53	11	1	35.20	7	5	39.58	4	7	43.86	5	10

Table 5.23 cont.

	Gp	ATH			ARG			COR			AG			EUBA		
UP27	ARG	40.40	10	7	30.07	8	5	51.18	4	13	84.34	0	17	39.67	7	4
UP28	ATH	13.48	16	2	43.56	6	7	49.46	5	8	82.33	2	14	39.93	10	5
UP29	EUBA	55.57	5	10	42.51	5	12	61.56	5	12	89.57	0	18	33.11	8	9
UP30	ARG	40.25	9	5	26.38	9	5	45.95	5	9	66.41	3	15	42.29	7	5
UP31	ARG	42.24	6	9	25.74	8	3	41.36	6	12	72.21	2	16	36.99	6	7
UP32	ARG	39.31	7	8	15.00	17	2	34.12	5	5	43.73	5	10	24.57	9	4
UP33	ARG	41.39	6	9	14.11	13	0	32.85	5	6	37.21	5	9	32.09	6	6
UP34	ARG	36.68	9	6	21.89	11	3	37.11	7	7	43.35	7	10	23.61	8	2
UP35	ARG	45.97	6	12	16.57	14	2	32.00	6	5	37.81	4	10	44.12	4	8
UP36	ARG	38.17	7	6	17.47	13	2	30.41	7	6	41.20	5	9	33.30	8	6
UP37	EUBA	47.61	7	9	36.87	7	8	39.66	7	8	57.21	5	11	36.85	3	3
UP38	ARG	57.41	2	10	31.38	11	5	49.30	6	10	78.67	1	14	45.72	6	7
UP39	EUBA	37.95	8	7	42.22	6	9	36.49	5	8	74.02	1	14	32.47	9	7
UP40	EUBA	57.37	0	12	45.37	4	11	61.24	4	12	82.19	3	14	36.64	7	6
UP51	ARG	52.27	5	11	24.24	11	3	40.33	6	7	56.37	5	12	44.25	3	7
AS20	AG	68.76	1	13	50.27	0	16	32.22	7	8	24.67	7	4	58.65	8	4
AS21	AG	58.77	3	12	36.83	2	9	26.43	9	5	9.59	16	0	47.13	5	10
AS22	AG	54.93	3	10	35.12	1	8	21.52	10	5	8.23	17	0	43.86	4	11
AS23	AG	51.75	5	10	28.35	6	6	26.29	8	5	16.27	13	1	45.10	4	10
AS24	AG	69.52	2	12	53.02	1	15	33.75	5	9	25.03	6	3	57.48	4	13
AS25	AG	55.09	2	9	36.41	2	9	23.77	9	6	7.86	19	0	43.23	4	10

KEY: **UP, AS:** sherds from Asine, **ATH:** Athens site group, **COR:** Corinth site group
ARG: Argive Black Glaze group, **AG:** Argive Geometric, **EUBA:** Euboean group.

On further analysis UP1, 2, 5, 6, and AS20-25 were identified as Argive Geometric, while the rest of Group 2 were Corinthian. This upheld the MAHALA assignments.

Group 4 appeared similar to Athens. Further analysis confirmed this. Dilution corrections with Group 4, Athens and Corinth, showed that two sherds, (Up12, 23), were actually Corinthian.(Appendix 4:D6) Their initial assignments were caused by dilution effects.

Group 3 was similar to Argos, while Group 1 showed alliances with Chalkis and Argos. The former association, caused by equivalent Cr concentrations, was dismissed on further analysis. Cluster analysis with Argos produced two clusters a) Group 3 and Argos and b) Group 1 alone.

Table 5.24

The Composition of Asine Group One.

Element	Mean	SD	%
Na	0.802	0.06	6.97
Al	9.16	1.22	13.39
K	3.68	0.71	19.27
Ca	4.35	1.43	32.90
Sc	19.9	2.01	10.10
Ti	0.534	0.06	11.16
V	118	16.9	14.25
Cr	182	25.6	14.08
Mn	540	125	23.11
Fe	4.74	0.23	4.83
Rb	160	13.1	8.21
Cs	8.75	0.52	6.02
La	35.9	2.19	6.12
Ce	72.1	6.29	8.73
Dy	4.95	0.39	20.17
Lu	0.412	0.03	8.49
Hf	4.90	0.74	15.13
Th	13.2	1.05	7.94
U	3.35	0.45	13.45

The composition of Group 1 reveals a disperse group with a common trend for low Cr and Mn contents. This trend was also displayed by the unassigned group identified during the Tiryns analysis, Tiryns 1. However, the members of Group 1 were not assigned to Tiryns by MAHALA. Comparing the group information shows slight differences for various elements particularly Ce and Hf.

Table 5.25

MAHALA Output for Asine Group 1.

Sample	Group	Tiryns 1		
UP3	TIRYNS	41.37	7	6
UP4	TIRYNS	30.89	9	6
UP7	TIRYNS	32.46	5	7
UP15	TIRYNS	44.16	7	9
UP24	TIRYNS	41.52	8	6
UP40	TIRYNS	38.14	6	8

To test the validity of these groups, Groups 1, 3, 4 and the Corinthian part of Group 2 were defined for MAHALA. This was used to compare the Asine groupings with the Argos, Corinth, Athens and Argive Geometric sherds.

The Corinthian Black Glaze sherds mixed with the Asine's Group 2 confirming it as Corinthian. Group 4 was also verified, when the Athenian sherds associated with it. The Argos sherds were assigned to Group 3, suggesting a possible origin. Finally Group 1 was isolated due to low Cr and Mn concentrations.

These results showed that Asine imported pottery from Corinth and Athens. These were well known exporters of pottery and so it was not surprising they exported to Asine. Some samples of Argive Geometric were found at Asine, showing that this style was found throughout the Argolid.

The sherds from Uppsala ranged in styles from Late Geometric, (UP1-8), through Archaic, (UP9-19), to Classical, (UP20-30), and Hellenistic, (UP31-40,51), Black Glaze. The Cambridge sherds were all thought to be Argive Geometric.

The Cambridge samples were all confirmed as Argive Geometric, as were four Uppsala sherds, (UP1, 2, 5, 6). These were all Late Geometric and thought to be local. This could imply that Asine was the source of Argive Geometric. As Argos was the most influential city in the area, it has always been believed that Argive Geometric was from there. However the dissimilarity of the Argive Geometric and Argive Black Glaze compositions suggest different clay beds. These could both be at Argos, but without evidence of a kiln this can not be prooved.

A mixture of Late Geometric and Archaic sherds were identified as Corinthian. These sherds had high Ca concentrations, a feature of Corinthian pottery, which had caused dilution effects, distorting the initial assignments. One of the sherds, (UP17), had been described as either Corinthian or Argive. Chemical analysis showed it was Corinthian, therefore highlighting the usefulness of NAA in provenance studies.

The majority of the possible Athenian sherds were Black-Figure ware ranging from Archaic to Classical, while the potential Argive group comprised of Classical and Hellenistic Black Glaze sherds. Finally a set of sherds formed the disperse group, Group 1, because of similar low Cr and Mn concentrations. Three of these sherds were thought to be local, suggesting Group 1 is an Asine fabric. This group has slight similarities with Tiryns 1. Further analyses of sherds of this type are required before a source can be identified.

Comparing the NAA results with the archaeological data[BAC92] has given some interesting results. Looking chronologically, the people of Asine used Argive Geometric pottery during the Late Geometric period.

Corinthian pottery was popular during the Late Geometric period and continued to be so into the Archaic period. Athenian Black-Figure ware was also evident during the Archaic period, becoming more popular in the Classical era. This is reflected at Asine where the majority of Archaic pottery was Corinthian, and Classical Black Glaze was Athenian.

Asine also began importing Black Glaze from the closer site of Argos in the Classical period. The presence of Argive pottery at Asine is not surprising as not only was Argos the major power in the region, it was also only a few kilometres from Asine. Of course this latter fact can be interpreted another way. As Argos and Asine were close, they may use clay beds of very similar composition.

5.7.7 Halieis.

Halieis was an important harbour in the southern Argolid. Thirty-one Black Glaze sherds from Halieis, (HAL7-35, 38, 42), had previously been analysed for long-lived elements.[TOM88] All the sherds were re-irradiated to determine the short-lived elements, and long-lived irradiations were repeated for eight sherds, (HAL7, 18, 21, 24, 27, 31, 34, 42).[Section 5.1]

Cluster analysis identified three outliers, (HAL10, 28, 42). After these were removed three clusters were formed.

1: HAL7-9, 12-14, 16-18, 24, 27.

2: HAL11, 23, 31-34, 38.

3: HAL15, 19-22, 25, 26, 29, 30, 35.

Group 1 had high Cr and Cs values implying an Attic origin. Group 3 had a large Mn content suggesting it was Argive.

Comparing the Halieis sherds with the database using MAHALA confirmed Group 1 was Athenian, and Group 3 was an Argive group. The assignments of Group

2 was varied. HAL31 and 32 were similar to Elis, HAL38 was close to Argive Geometric, and the remainder were outliers. The outlier HAL28 associated with the Spartan sherds. Unlike other Argive sherds this did have a similar Rb value to the Sparta material.

5.7.8 Discussion.

The analysis of pottery production in the Argolid was expanded to include six additional sites, (the results of which are summarised in Figure 5.6 and Appendix 3). These sites were Mycenae, Berbati, Argive Heraeum, Tiryns, Asine and Halieis.

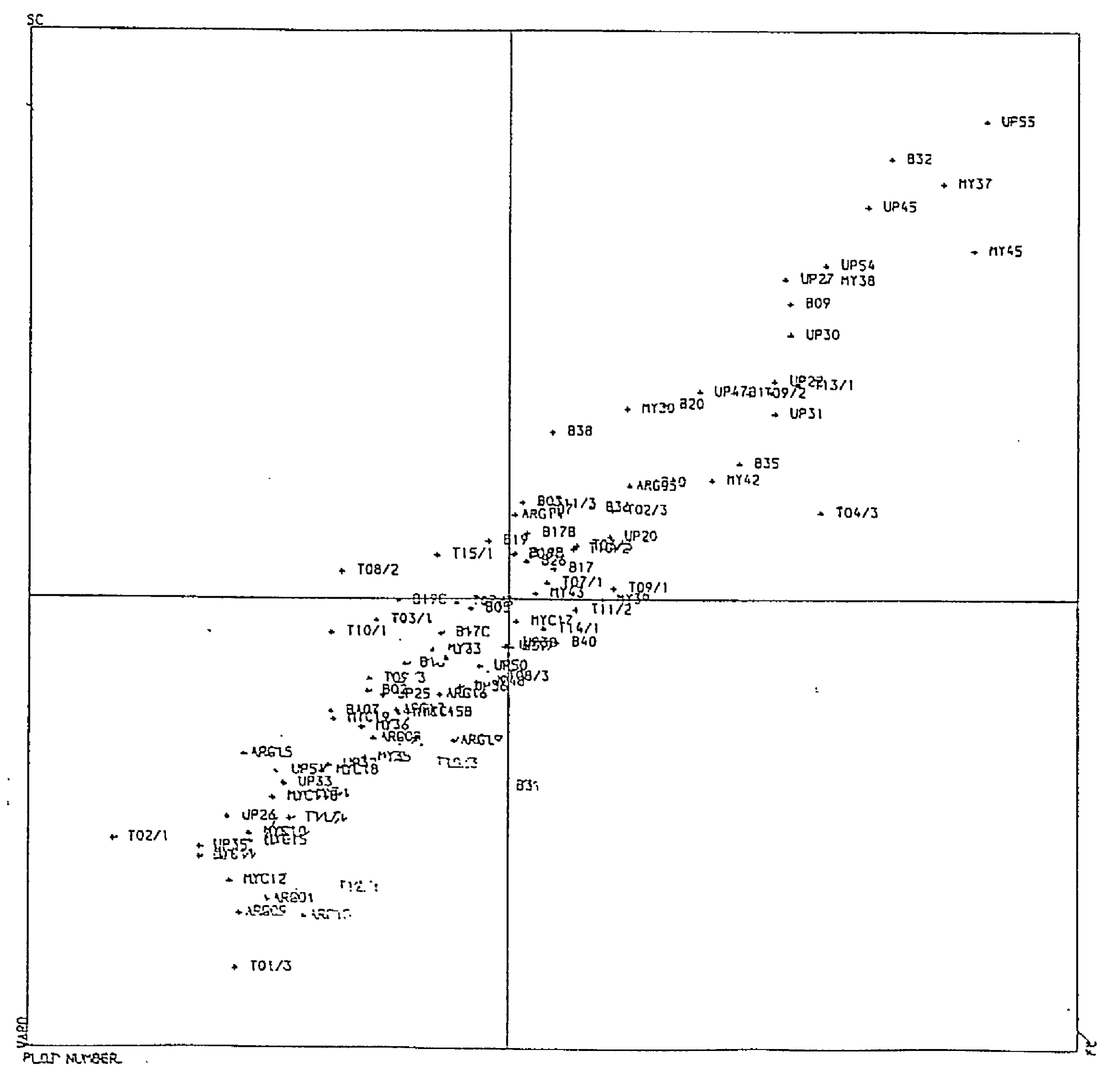
The sherds from Mycenae included two types of ware, Black Glaze and Argive Geometric. The latter was a local ware popular in the eighth century before the rise of Black-Figure ware. Cluster analysis separated the two wares. On comparison with the database, the Black Glaze sherds associated with the Argos Black Glaze group, while the Argive Geometric sherds remained isolated. These results suggest that Argive Geometric and Argive Black Glaze are from different sources.

Having determined a new fabric, the Argive Geometric group was included in the database for all futher analyses. This led to the identification of Argive Geometric pottery at Berbati, Argive Heraeum, Argos, Tiryns, Asine and Halieis. The Asine sherds were thought to be of local manufacture, suggesting Asine was the source of this style. However Asine was thought to have been abandoned at that time, and the source of Argive Geometric pottery has always been believed to be Argos.[PRA94] Without evidence of a kiln the source cannot be identified. No Argive Geometric sherds have been identified outside the Argolid, affirming it was a local ware.

The same problem of no definitive evidence of pottery production occurred in the analysis of Argive Black Glaze. Sherds of this type, which are similar to the Argos group identified in Table 5.9, were found at Asine, Mycenae, Berbati, Tiryns

Figure 5.5

Argive Black Glaze Correlation (Sc/Fe).



and Halieis. This suggests either one production site for all the pottery, or local manufacture from a common source of clay. The site analysis of Argos identified a correlation between Sc and Fe. This was also seen for every Argive Black Glaze group. The correlation coefficients were calculated for the total data set.(Figure 5.5) The range of concentrations or geological homogeneity was the same for all six Argive sites suggesting a single clay source or bed. Therefore an Argive Plain Source has been identified.

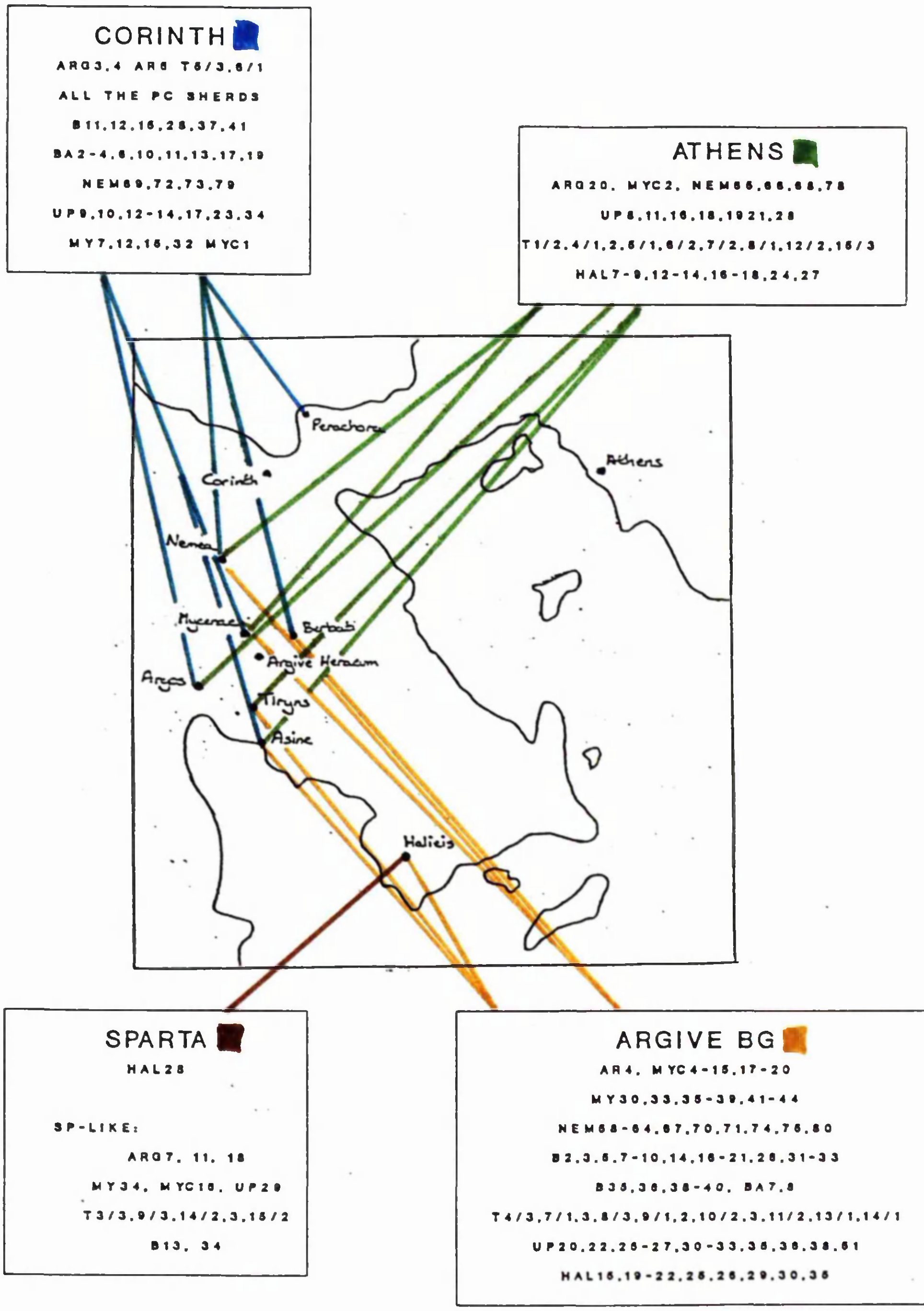
An additional suspected Argive group was defined. This was observed in the site analysis of Asine. A set of 7 sherds, (UP3, 4, 7, 15, 24, 34, 40) known as Group 1, formed an isolated group with low Cr and Mn concentrations. The archaeological information suggested that three of these sherds were made locally. Again without evidence of a kiln this can not be verified. A similar group was identified at Tiryns, (T1/3, 2/1-3, 3/1, 10/1, 11/1, 3, 12/1, 15/1). These were also separated due to low Cr and Mn values, hinting at a possible link between Asine and Tiryns.

Imports from Athens were seen across the Argolid at Mycenae, Asine, Argos, Tiryns, and Halieis. This was expected as Athens was such a major producer of Black-Figure and Glaze Ware it would have been found throughout the Mediterranean. Corinth also exported to the Argolid, though not so widely. Corinthian pottery was found at Mycenae, Berbati, Tiryns and Asine.

A selection of outlying sherds from Argos, Mycenae, Berbati, Asine, Tiryns and Halieis showed similarities to the Spartan groups. This was mainly due to the trend for high Ce and Th concentrations. All of these associations were disproved with the exception of HAL28 and MY34. Three Tiryns sherds, (T14/2,3 15/2), formed a group with Spartan characteristics suggesting an, as yet, undefined Laconian source.

Figure 5.6

Trade in the Argolid.



Argive Geometric Pottery was found at all of the Argolid sites, and is assumed to have originated from Argos.

5.8 Argive and Corinthian Handmade wares.

The provenance study of Black Glaze pottery in the Argolid was further expanded to include the Handmade wares of the Archaic potters from the Argolid and Corinthia, which included some samples of Argive Monochrome. This was an undecorated, coarse ware common only to the Argolid.

200 Handmade ware sherds were supplied by Dr.N.Kourou of Athens University. These comprised 11 sherds from Corinth, (NTH1-11), 44 from Argos, (AM1-44), and 109 from Tiryns, (OM).

5.8.1 Tiryns.

The Handmade wares found at Tiryns were supplied in five excavation groups, OM1-5, with OM2 and 5 having further sub-divisions, (i.e OM2A, B, C).

Analysis of the total data set produced four clusters, two of which were comprised solely of the excavation groups OM1 and 2 respectively. The remaining two groups contained OM3 and 5B respectively with OM4 and 5A split between them. The FACTOR program, which calculates and corrects for dilution, was used to determine if these original assignments were caused by dilution. The same four clusters were seen, hence no dilution. As the sherds, on the whole, remained in their excavation groups, it was decided to continue with individual group analysis.

Cluster analysis of the thirteen samples in OM1, (OM101-13), produced two close groups with one outlier OM113, which was of poorer quality than the other sherds.[(KOU94)] The samples were treated as a twelve member group which then separated from the other Tiryns groups. This could have been due to the fabric type. OM1 was a much finer ware with no inclusions compared to the other Tiryns sherds.

The thirty-six sherds which made up OM2 were contained in three subdivisions, (OM2A1-11, 2B1-16 and 2C1-9). All are made from a soft, dark clay ranging in colour from red to grey. Cluster analysis highlighted five outliers (OM2A02, 7, 8, B06, 16). The removal of these gave a random mix of the three close subgroups, indicating a homogeneous group. Like OM1, OM2 separated from the other four sites suggesting a distinctive fabric.(Table 5.26)

Table 5.26

The Composition of OM2.

Element	Mean	SD	%
Na%	0.734	0.16	22.53
Al%	7.47	0.44	5.92
K%	1.88	0.20	10.89
Ca%	1.00	0.18	18.80
Sc	16.3	0.69	4.23
Ti%	0.396	0.02	6.36
V	95.8	8.15	8.51
Cr	217	21.7	10.03
Mn	741	87.6	11.83
Fe%	4.55	0.16	3.63
Rb	94.1	14.0	14.88
Cs	4.63	0.55	11.95
La	28.6	1.90	6.63
Ce	58.6	5.98	10.21
Dy	4.21	0.38	9.21
Lu	0.358	0.04	11.62
Hf	4.97	0.52	10.61
Th	10.4	0.92	8.87
U	3.22	0.47	14.72

Analysis of the twenty-one sherds of OM3, (OM301-4, 6-9, 11-23), identified two outliers, (OM309, 11), and a five member outlying group (OM301-4, 7). The rest of the sherds formed a group, which as expected separated from OM1 and 2. Comparison with OM4 and 5 showed some similarities with two OM4 sherds and the OM5A group.

The ten sherds in OM4, (OM401-10) split between OM3 and 5B in the total data set analysis, so it was no surprise that it formed a disperse group when analysed alone. The split of samples was repeated in the individual comparisons with OM3 and

OM5.

1: OM401, 6, 9, 10 with OM3.

2: OM402-5, 7, 8 with OM5B.

Analysis of the twenty sherds of OM5 produced two groups. One consisting of OM5B, (OM5B01-10) with OM5A01 and 5, the other of the remaining OM5A, (OM5A02-4, 6-10), sherds. Comparison with OM3 showed similarities with the OM5A group, while OM5B was separate. OM4 split between the groups; OM401 and 6 with 5A, the rest with 5B.

The results of the individual analyses suggest there are four Tiryns groups, (OM1, OM2, OM3 and OM5B), though not necessarily originating from there. The groups were tested using the MAHALA program, which compares each sample with the means and standard deviations of each defined group. A sample is then assigned to the group to which it is most similar.

OM1: OM101-12.

OM2: OM2A1, 3-6, 9-11, 2B1-5, 7-15, 2C1-9.

OM3: OM306, 8, 12-23, OM401, 6, 9, 10, OM5A2-4, 6-10.

OM5B: OM5B1-10, OM402-5, 7, 8, OM5A1, 5.

The four original groups, above, were upheld. MAHALA also compared the Tiryns groups with the other Argive Monochrome sites. OM1 associated with the Corinth sherds and Group 3 with Argos. OM2 and OM5B were isolated, suggesting two distinctive fabrics of unknown origin.[Tables 5.26, 27]

Table 5.27

The Composition of OM5B.

Element	Mean	SD	%
Na	0.700	0.05	8.17
Al	8.06	0.22	2.82
K	2.50	0.18	7.42
Ca	8.63	0.33	3.88
Sc	19.5	0.84	4.29
Ti	0.456	0.02	5.70
V	127	4.70	3.69
Cr	186	10.5	5.65
Mn	1170	134	11.5
Fe	5.02	0.19	3.93
Rb	117	6.94	5.89
Cs	5.77	0.39	6.86
La	30.5	1.49	4.88
Ce	62.9	3.54	5.63
Dy	4.54	0.26	5.88
Lu	0.386	0.03	7.95
Hf	3.94	0.34	8.75
Th	10.6	0.56	5.30
U	5.04	0.36	7.19

5.8.2 Argos.

The Argos sherds were, like Tiryns, supplied in a range of excavation groups relating to the plot of land the sherds were found on. Due to the smaller amount of sherds the analysis concentrated on the data as a whole, (AM01-44).

This analysis highlighted four outliers, (AM13, 20, 21, 22), and two pairs AM23, 24 and AM28, 29. The first pair had a large Ca concentration suggesting a Corinthian origin. The second pair were both of the Bucchero type,[KOU94] which contained a small amount of calcium. This led to an association with the unassigned Tiryns group OM2, however the calcium was larger for the outlying pair.

The rest of the samples split into two groups; a small cluster of mainly outliers, (AM15, 16, 22, 44), and a larger group possibly a site group. Removing the outlying group gave two similar clusters. To check how similar these groups were, the means and standard deviations were calculated for one of the groups, named Group 1. Using

MAHALA, all the Argos sherds were compared with Group 1. The majority of sherds, with the exception of the previously defined outliers, were assigned to Group 1, suggesting one large group. Consequently, Group 1 was redefined to contain all the samples within the group.(Table 5.28)

Table 5.28

Argive Handmade Ware.

Element	Mean	SD	%
Na%	0.377	0.11	28.47
Al%	7.98	0.63	7.92
K%	2.76	0.38	14.00
Ca%	8.10	1.46	18.14
Sc	23.3	1.75	7.52
Ti%	0.403	0.03	9.21
V	134	12.3	9.23
CR	397	66.3	16.71
MN	917	154	16.87
FE%	5.67	0.42	7.44
RB	132	18.5	14.01
CS	8.14	1.09	13.39
LA	26.75	2.52	9.42
CE	52.0	5.41	10.39
DY	3.69	0.40	10.90
LU	0.361	0.07	19.75
HF	2.75	0.32	11.65
TH	9.4	0.96	10.24
U	3.55	0.75	21.35

The Argive Handmade Ware group was then compared with the other Argive Monochrome sherds. Again OM3, some of OM4 and 5A affiliated with the Argos group, indicating a link between Argos and Tiryns. Of the nine outliers identified during analysis, two, AM23 and 24, were confirmed as Corinthian, and AM22 associated with the, as yet, unassigned Argive Handmade Ware group OM2.

5.8.3 Corinth.

As there were only eleven sherds attempts at identification of a site group proved meaningless. Comparison with the Argive Handmade ware sherds gave a clear link with OM1. The rest separated. This was confirmed by the MAHALA program, implying a link between Corinth and Tiryns. Looking at the fabric of the Corinth and OM1 samples confirms this result. Both are made from a finer clay than the Argive Handmade ware sherds.

5.8.4 Discussion.(Figure 5.7)

Single site analyses had defined six groups, some of which appeared close to others. To check for any similarities the handmade ware database was compared with all six site groups using MAHALA. The results confirmed our findings.

Table 5.29

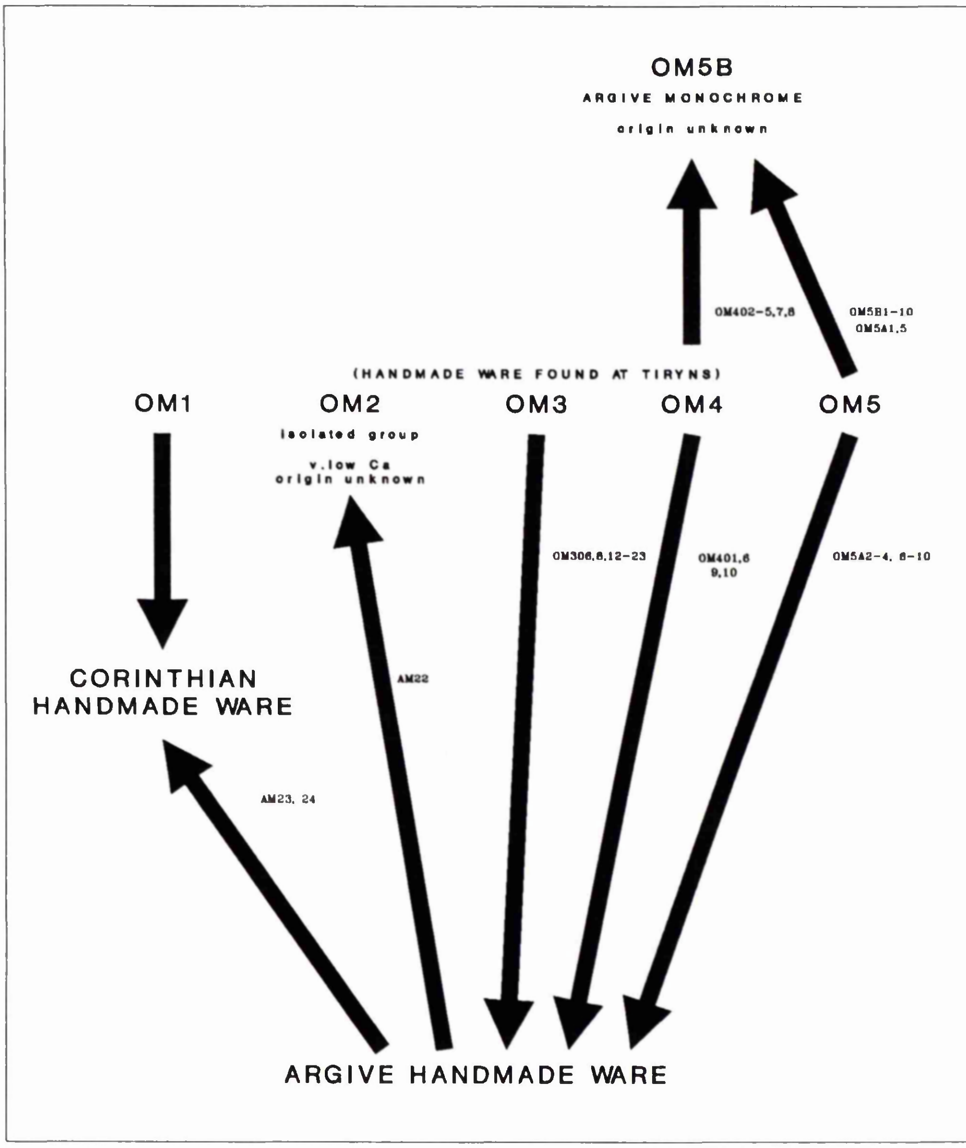
Comparison of Corinthian Handmade Wares.

Sherd	Group	OM1			COR		
OM101	OM1	12.74	15	1	20.67	12	3
OM102	OM1	21.55	8	1	40.12	7	8
OM103	OM1	9.69	17	0	23.19	11	4
OM104	OM1	11.75	15	0	27.13	10	4
OM105	OM1	10.43	14	0	15.19	15	2
OM106	OM1	14.36	14	0	28.92	7	5
OM107	OM1	20.06	9	1	21.90	12	3
OM108	OM1	11.03	17	0	23.11	11	3
OM109	COR	21.78	7	0	18.45	11	1
OM110	COR	19.72	10	0	19.08	12	1
OM111	OM1	13.96	15	0	24.71	9	5
OM112	COR	15.47	15	2	12.96	16	2
OM113	COR	26.53	10	4	21.20	13	4

The assignments(Table 5.29) for the OM1 sherds varied between OM1 and the Corinth group. The Corinthian sherds, with the exception of NTH09, all remained

Figure 5.7

Summary of the Handmade Ware Analyses.



within their site group. However all of the sherds were close to both groups, suggesting similarity. As Corinth is a well established pottery manufacturer it has been assumed OM1 sherds are from Corinth. This was in agreement with the archaeological information, which described OM1 as well levigated Argive Monochrome sherds possibly from Corinth.(KOU94)

A similar picture was seen for OM3 and the Argive Handmade ware group.(Table 5.30) The majority of samples gave ambiguous results. However the Argive group did appear the more prominent, therefore OM305-8, 12-23, OM401,6 and OM5A02-4,6-10 are from Argos. These were all examples of Argive Handmade wares. OM401 and OM406 were of the same fabric to that of OM3, which was made up of Pie ware sherds.(KOU94)

Finally OM2, due to very low Ca concentrations, and OM5B, which consisted of Argive Monochrome sherds, separated from the other groups, suggesting one or both is the Tiryns site group.

5.8.5 Comparison of Styles.

The purpose of analysing the Handmade ware sherds was to improve the provenance results for the Argolid. Hence comparisons with the Black Glaze and Geometric groups for the relative sites were performed.

The Corinthian compositions were very similar, particularly the Cr, Lu and Hf values.(Table 5.31) The Corinthian Handmade ware group also had a high calcium concentration, a characteristic of Corinthian pottery. To substantiate these findings MAHALA was run for the Corinthian sherds. The Black Glaze sherds affiliated with the Corinth Handmade ware group.

Table 5.30

Comparison of Argive Handmade Wares.

Sherd	Group	OM3			AHW		
OM301	AHW	53.66	2	12	43.54	5	12
OM302	AHW	32.03	7	8	27.63	8	5
OM303	AHW	41.43	5	10	32.24	7	9
OM304	AHW	36.60	7	4	26.66	7	4
OM305	OM3	16.10	14	2	19.65	11	3
OM306	OM3	26.66	7	3	29.79	7	7
OM307	AHW	17.95	10	1	17.31	13	2
OM308	OM3	14.46	12	1	16.97	13	1
OM309	AHW	29.17	9	6	27.61	7	5
OM311	OM3	23.00	8	4	30.24	7	5
OM312	OM3	15.62	12	0	16.89	11	2
OM313	AHW	19.32	11	1	17.44	10	2
OM314	AHW	13.30	15	0	13.04	13	0
OM315	OM3	14.02	14	0	18.71	10	1
OM316	OM3	11.15	17	0	13.99	14	1
OM317	OM3	13.86	15	0	17.66	13	2
OM318	OM3	12.65	16	0	15.68	12	0
OM319	OM3	13.62	15	0	17.14	10	0
OM320	OM3	14.94	12	0	15.49	11	1
OM322	AHW	15.89	13	1	12.62	14	0
OM323	OM3	12.46	15	1	16.30	14	1

		OM3			AHW			OM5B		
OM401	AHW	14.03	13	1	11.36	14	1	38.79	4	7
OM402	OM5B	36.55	5	6	25.49	10	8	19.02	12	1
OM403	OM5B	44.09	5	11	28.62	10	7	18.96	12	3
OM404	OM5B	48.11	4	11	39.62	5	9	18.50	9	0
OM405	OM5B	34.30	5	8	24.96	9	4	18.00	9	0
OM406	AHW	19.08	13	4	10.23	15	0	32.75	7	7
OM407	OM5B	53.02	4	10	42.69	8	8	24.84	9	3
OM408	OM5B	38.44	6	9	28.33	8	6	19.95	10	2
OM409	AHW	25.24	10	4	16.16	12	1	36.53	6	7
OM410	AHW	22.91	10	3	17.45	12	2	38.44	6	6
OM5A1	OM5B	44.25	5	9	31.71	6	7	8.38	16	0
OM5A2	AHW	17.42	14	0	16.80	12	2	38.37	5	10
OM5A3	OM3	10.55	17	0	19.47	9	4	38.85	6	8
OM5A4	OM3	7.43	18	0	21.59	9	3	32.15	9	8
OM5A5	OM5B	36.68	8	8	31.45	7	8	15.50	12	0
OM5A6	AHW	16.16	9	1	12.12	16	0	35.51	6	8
OM5A7	OM3	25.15	6	3	43.46	2	11	42.47	7	9
OM5A8	OM3	16.28	11	0	34.27	7	9	41.38	7	9
OM5A9	OM3	11.85	14	0	28.18	5	4	36.99	8	10
OM5A10	OM3	13.59	15	0	24.85	9	5	40.09	5	9

KEY: OM: Handmade ware found at Tiryns, **AHW:** Argive Handmade ware
OM3: Tiryns Handmade ware group, **OM5B:** Unassigned Tiryns HW Group

Table 5.31

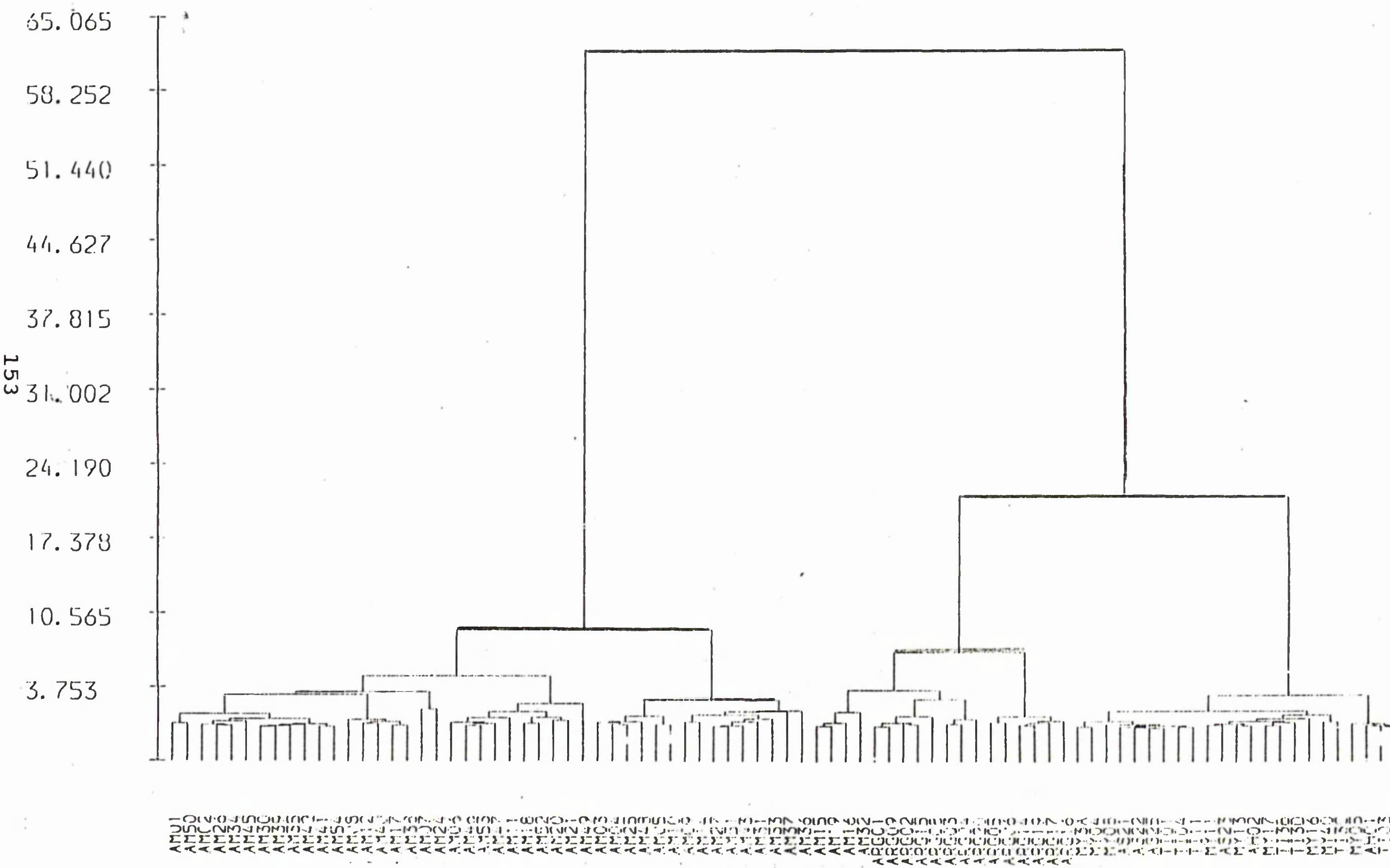
Comparison of Corinthian Compositions.

	Corinth BG.		Corinth HW.	
Element	**Mean**	**SD**	**Mean**	**SD**
Na%	0.527	0.12	0.431	0.11
Al%	8.03	0.70	8.81	0.63
K%	2.21	0.37	2.98	0.33
Ca%	10.7	1.83	9.41	0.87
Sc	23.1	2.02	23.1	1.65
Ti%	0.461	0.05	0.490	0.02
V	134	16.8	151	17.7
Cr	256	25.3	255	20.6
Mn	949	94.0	882	90.7
Fe%	5.86	0.51	5.91	0.28
Rb	144	18.4	157	19.7
Cs	9.45	1.00	10.2	1.24
La	33.8	2.25	33.3	2.13
Ce	61.8	5.39	63.5	4.58
Dy	4.47	0.43	4.28	0.27
Lu	0.413	0.04	0.412	0.06
Hf	3.35	0.45	3.39	0.30
Th	11.6	0.91	11.3	0.74
U	3.43	0.60	4.42	0.37

These results have produced evidence for a uniform clay source at Corinth, which can be seen in the characteristic pale fabric. Both the Black Glaze and Argive Monochrome sherds have this fabric, which can be used to, visually, separate the Corinthian sherds from the rest of the Handmade ware sherds.

No resemblance was seen between the Argive Black Glaze, Argive Geometric and Argive Handmade ware groups.(Dendrogram 5.3) Visually the two types of clay were totally dissimilar. The Handmade ware sherds were made from a well levigated clay which appeared to be coarser than the finer fabric, (ranging in colours from tan to orange), of the Black Glaze sherds. These results suggest that either two extraction sites were used, or that the production processes were different.

The only other similarity was seen between OM5B and the Argive Geometric samples. Further analysis showed that these groups were indeed close, but not close



Dendrogram 5.3 Argive Comparisons (HW, (AM), BG, (ARG), AG, (MY)).

enough to be regarded as a single group. OM5B was distinguishable due to high V, Mn and U concentrations.(Appendix 4:D7)

Finally OM2 remained distinct from all groups of Black Glaze or Argive Geometric pottery. This was because of very low calcium values.

5.9 Festival Sites.

The Panhellenic Games at Olympia and Nemea were important events in the Greek World, and would therefore have attracted many people from all over Greece, and from Greek colonies across the Mediterranean. As a result the pottery found at these sites is likely to be varied, but not local. Hence the provenance of pottery from festival sites is useful in identifying the origins of festival goers, and testing the analytical technique.

5.9.1 Olympia.

Twenty Black Glaze sherds, (OLY1-20) and two Byzantine sherds, (OLY21, 23) found at Olympia were analysed by NAA. The Byzantine sherds were from a kiln, hence local clay, though 1000 years after the Classical period. All of these sherds had been previously analysed at MUCD.(BUR86,TOM88) All were irradiated for the short-lived elements and eight sherds, (OLY6, 7, 11, 15, 17, 18, 21, 23), were re-irradiated for long-lived elements.(Section 5.2)

As expected the MAHALA assignments for Olympia were varied, with samples associating with Elis, Athens, Corinth and Argos.(Table 5.32)

Cluster analysis identified an outlying pair, (OLY21, 23). These were the Byzantine sherds, hence implying a different fabric for these local sherds. As expected the Black Glaze sherds were not of local manufacture. After the removal of the

Table 5.32

Provenance of Olympia.

Sample	Group	ATHENS	ARGOS	CORINTH	ELIS
OLY01	ELIS	48.10 3 10	32.79 6 8	38.31 6 7	26.47 11 4
OLY02	COR	33.78 7 7	47.88 3 9	30.15 10 3	49.24 5 13
OLY03	ELIS	41.25 5 9	35.02 5 9	38.43 7 7	28.02 9 5
OLY04	ARG	44.18 6 7	24.36 8 4	29.87 8 7	50.50 4 8
OLY05	COR	52.10 4 13	34.87 5 6	31.45 7 7	53.68 6 10
OLY06	COR	65.82 0 15	70.50 2 14	51.32 4 9	96.77 1 13
OLY07	COR	41.05 8 5	45.46 4 6	24.75 12 3	40.67 7 7
OLY08	ARG	38.53 7 7	30.93 9 6	48.34 3 12	71.98 5 14
OLY09	ARG	36.27 8 6	24.28 8 3	32.70 7 6	38.17 7 9
OLY10	COR	60.20 4 11	41.60 4 9	33.54 7 8	45.84 9 8
OLY11	ELIS	44.89 6 8	32.56 4 7	22.74 10 4	21.06 10 2
OLY12	ARG	43.45 5 8	25.29 7 4	32.07 9 7	49.25 5 12
OLY13	ELIS	42.82 5 8	31.19 9 7	25.58 9 2	22.48 9 5
OLY14	COR	45.90 3 8	27.62 7 4	22.58 9 2	45.25 6 7
OLY15	ATH	14.17 14 1	50.91 6 8	49.50 7 7	59.80 5 13
OLY16	COR	26.65 12 4	31.06 4 4	22.25 9 1	36.62 6 5
OLY17	COR	56.60 1 13	46.94 3 10	35.95 6 7	65.28 4 12
OLY18	COR	51.49 1 11	39.68 8 9	23.31 10 4	50.34 2 10
OLY19	ATH	31.14 8 5	33.92 7 6	32.76 8 5	50.33 6 9
OLY20	ARG	41.95 9 8	39.99 5 7	41.99 3 9	50.34 5 9
OLY21	COR	86.58 0 18	81.46 1 18	53.16 1 13	96.52 1 15
OLY22	COR	76.56 0 16	59.31 2 14	36.01 6 9	87.56 3 15

outliers a mixed result was seen. The inclusion of the Elis, Corinth, Athens and Argos groups, (identified in Section 5.3), cleared up this picture. The four site groups separated, each of the clusters contained some Olympia sherds.(Appendix 4:D8)

1: OLY1, 3, 9, 11, 13 with Elis.

2: OLY2, 7, 16 with Corinth.

3: OLY15 with Athens.

4: OLY 8, 19, 20 with Argos.

The majority of sherds appeared to be from Elis. This was expected as Elis controlled Olympia from 471BC. The presence of sherds from Corinth, Athens and Argos is also not suprising as the Panhellenic Games were very popular. Not all the Olympia sherds were identified. Of these remaining sherds five, (OLY4, 5, 10, 14, 15), formed a close group suggesting a single source not included in the compositional database.

5.9.2 Nemea.

Twenty-three Black Glaze sherds from Nemea, (NEM58-80), were examined to determine the source of the pottery. As Nemea was a festival site on the Corinthia/Argolid border, Corinth and Argos were the expected pottery suppliers.

MAHALA showed three groups of sherds, one similar to Argos, one to Athens and one to Corinth. Three outliers, (NEM63, 76, 77), were also identified.

To test these assignments the four sites were analysed together. Cluster analysis produced three groups, which upheld the MAHALA assignments.(Appendix 4:D9)

1: NEM69, 72, 73, 79. Corinthian

2: NEM58-62, 64, 67, 70, 71, 74, 75 , 80. Argive

3: NEM65, 66, 68, 78. Athenian

Nemea was a religious sanctuary and was expected not to have made its own pottery. This was confirmed as all but three sherds were assigned to one of three sites. These were Argos, Corinth and Athens.

Until the middle to late fifth century BC the Nemean Games were under the control of the neighbouring town of Cleonae, but then Argos took over and by the early fourth century the Games were moved to Argos. The Games are believed to have returned, briefly, to Nemea in the late third century, but still under Argive rule. Nemea lay in the mountains between Argos and Corinth, therefore it was not surprising that the both sites had supplied Nemea or that Argive pottery predominates. Athenian ware was the most sought after pottery, hence was likely to be found at the festival site.

5.10 Exportation.

The movement of pottery around a region can help to determine the trade routes and influential cities within that region. In the Mediterranean during the Classical period, Athens was the most influential pottery manufacturer. Imported Greek sherds from Jordan and Israel, along with a set of 25 museum pieces, were analysed to ascertain the extent of Athenian influence, and that of other Greek cities.

5.10.1 Israel and Jordan.

A set of thirty sherds from Lachish, Israel, (LA01-30), were analysed along with one sherd, IK6, from Iktanu, Jordan. MAHALA indicated that the majority of the Lachish sherds and the Iktanu sherd were Athenian. Three Lachish samples, (LA23-25), associated with the Corinthian site group. The remaining sherds were left unassigned.

Cluster analysis of the Lachish sherds with the Athenian and Corinthian site groups confirmed the MAHALA results.(Dendrogram 5.4) Therefore, the Lachish sherds formed three groups.

1: LA01-11, 16-19, 26-30. Athenian.

2: LA23-25. Corinthian.

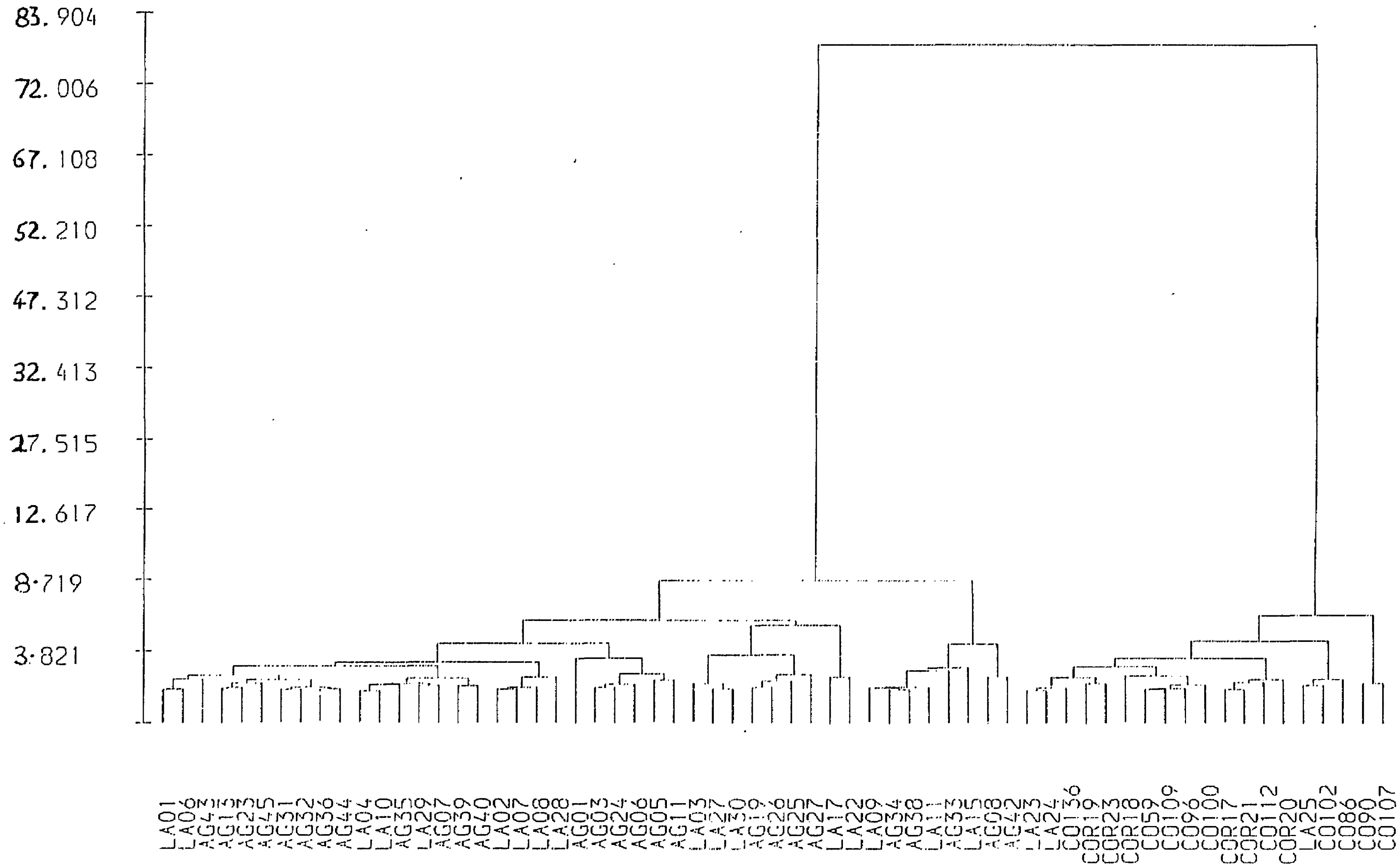
3: LA13-15, 20-21. Outliers.

Turning to the archaeological information available, the Iktanu sherd was suspected to be from Athens. This has been confirmed by the distinctive high Cr and Cs concentrations.

The Lachish sherds, with the exception of LA23-25, were described as Athenian. This was confirmed, by chemical analysis, for all the sherds except LA13-15, 20-21. These contained unusually high Mn concentrations, which would suggest an Argive origin. However, the sherds did not associate with the Argive Black Glaze group,(Table 5.9) and have been left unassigned. The three non-Attic sherds were considered to be Corinthian. Once again chemical analysis re-affirmed the archaeological data.

5.10.2. Museum Pieces.

Twenty-five display pieces, (POT01-25), sampled at the Manchester Museum, were analysed to test the group assignments made by NAA. Cursory notes had been



Dendrogram 5.4 Lachish, (LA), Corinth, (CO) and Athens, (AG).

made on their suspected production sites, which suggested sites in Euboea, Boeotia, Attica and Southern Italy.

Initially the MAHALA program was used to compare the POT samples with the Euboean, Akraiphnion, in Boeotia, and Attic groups identified in Section 5.3.(Table 5.33) The results showed similarities between half the museum pieces and the three site groups. These assignments were examined further using cluster analysis.(Table 5.34) Table 5.34 lists the distances for the four closest sherds to each POT sample.

The results of MAHALA and WARD were identical, therefore suggesting that POT01, 19 and 23 originated from Euboea and seven samples, (POT09, 12, 13, 16-18, 24) were Attic. Finally two pots, (POT07, 8) were similar to Akraiphnion, suggesting a possible Boeotian origin. Obviously not all the museum pieces were assigned, suggesting that the remaining samples were from other sources.

Looking at the archaeological data, POT07 and 8 were judged to be Boeotian. Cluster analysis also suggested this. MAHALA indicated that POT08 was from Akraiphnion. However, as Akraiphnion was not a great metropolis, the results suggest that POT08 was made from the same clay as that used at Akraiphnion. POT07 was not assigned to the Akraiphnion group by MAHALA. This implies that POT07 maybe Boeotian, but from a different clay source.

POT12, 13, 17, 18, were all described as Attic Black-Figure ware. Chemical analysis has confirmed this, and identified four more Athenian vases. These included POT09 which has been previously analysed.[VON69,BOA73] Von Bothmer described POT09 as Euboean, while Boardman *et al*, using OES, identified the sample as Athenian. Our results confirm the latter's findings.(Section 5.13)

No comments on the suspected producer of the three sherds POT01, 19, 23 had been made by the archaeologist. NAA identified these as Euboean, hence highlighting the usefulness of chemical analyses in the provenance of pottery.

Table 5.33 **MAHALA** Output for POT samples.

Sample	Group	AK			ATHENS			EUBA		
POT01	**EUBA**	90.30	3	14	46.62	6	5	**16.78**	**10**	**1**
POT02	AK	35.28	6	10	36.21	6	6	45.56	6	9
POT03	EUBA	63.79	5	12	45.53	6	8	44.08	5	9
POT04	AK	36.56	5	9	38.12	4	7	47.85	6	10
POT05	ATHENS	35.14	6	10	34.49	6	6	51.50	6	12
POT06	AK	29.08	7	6	33.83	9	6	49.24	6	9
POT07	AK	30.17	6	5	35.76	7	4	54.12	5	9
POT08	**AK**	**20.98**	**10**	**3**	37.56	6	8	57.96	3	10
POT09	**ATHENS**	52.83	6	11	**13.73**	**15**	**1**	46.71	11	6
POT10	AK	33.05	5	7	33.32	6	6	48.53	4	11
POT11	AK	30.04	9	7	42.49	6	7	52.01	4	11
POT12	**ATHENS**	50.58	5	12	**14.29**	**16**	**1**	43.96	7	4
POT13	**ATHENS**	54.33	4	12	**13.33**	**16**	**1**	45.71	9	5
POT14	ATHENS	30.06	8	7	28.37	11	5	44.15	7	10
POT15	EUBA	53.60	3	13	47.90	6	10	43.70	7	10
POT16	ATHENS	48.73	8	11	30.74	9	6	40.45	5	8
POT17	**ATHENS**	41.89	7	8	**18.99**	**15**	**2**	43.22	10	7
POT18	**ATHENS**	70.58	3	13	**23.06**	**10**	**3**	52.19	5	4
POT19	**EUBA**	92.86	3	14	43.79	6	7	**18.46**	**10**	**0**
POT20	ATHENS	48.78	7	10	37.09	8	5	40.29	3	7
POT21	ATHENS	49.81	4	10	34.20	7	4	43.44	8	6
POT22	EUBA	61.24	7	9	59.45	5	9	59.25	5	11
POT23	**EUBA**	82.02	3	14	39.97	7	5	**16.85**	**12**	**1**
POT24	**ATHENS**	49.98	7	11	**27.63**	**11**	**3**	53.22	8	8
POT25	EUBA	57.71	6	11	49.80	5	9	48.27	4	13

Table 5.34

K-Linkage List, (Nearest Neighbours), for POT Samples.

Sherd	Group	Dist	Sherd						
POT01	CHK	0.313	POT23	0.323	POT19	0.601	AK24	0.669	AK25
POT07	AK	0.522	AK33	0.801	POT06	0.912	POT17	0.961	POT08
POT08	AK	0.372	AK27	0.523	POT06	0.646	AK26	0.685	POT10
POT09	ATH	0.215	AG34	0.224	AG38	0.271	AG36	0.293	POT13
POT12	ATH	0.081	POT13	0.346	AG06	0.371	POT09	0.401	AG36
POT13	ATH	0.081	POT12	0.257	AG06	0.293	POT09	0.330	AG36
POT16	ATH	0.739	AG40	0.744	POT12	0.778	AG36	0.848	POT18
POT17	ATH	0.302	POT24	0.369	POT14	0.417	POT12	0.438	POT09
POT18	ATH	0.320	POT09	0.411	AG38	0.506	POT13	0.532	AG34
POT19	CHK	0.307	POT23	0.323	POT01	0.511	AK24	0.696	AK43
POT23	CHK	0.307	POT19	0.313	POT01	0.459	AK25	0.539	AK43
POT24	ATH	0.302	POT17	0.466	POT04	0.515	POT14	0.553	POT09

Unfortunately, the site composition database was limited to sites on mainland Greece. Hence, some sherds were not identified because of the lack of data. However, these samples have been established as not originating from the Greek sites available. The archaeological information suggested a Campanian or Etruscan producer, and our results are consistent with a non-Greek origin.

5.11 Outliers.

The majority of the sherds analysed for this project have been assigned to one of the fourteen compositions identified during the present study. However approximately 10% of the sherds remain unassigned.

Table 5.35

Outlier Assigments.

Sample	**Omitted elements**	**Group**
AG02	Sc/Ca	Athens
AG04	Hf	Athens
AG10	Th	Athens
AG12	Ca	Athens
AG13	Ca	Athens
COR22	Ce	Corinth
COR24	Mn	Corinth
COR34	Ca	Corinth
CO46	Ce/Rb	Corinth
ELI02	Rb	Elis
ELI03	Mn	Elis
ELI18	Mn	Elis
C47	Cs	Athens
CH39	V	Euboea
PC03	Ca	Corinth
PC40	Na/Rb	Corinth
PC54	Na/Rb	Corinth
BA3	Ca	Corinth
BA8	Mn	Argive BG
BA15	Rb	Corinth
NEM63	Rb	Argive BG
OM2B16	Cs	OM2
OM311	Cs	Argive HW

The outlying nature of a number of these sherds was due to one or two anomolous concentrations. By omitting these elements from the statistical analysis, the origins of a selection of the outliers were identified.(Table 5.35)

The remaining outliers, with no irregular results, have been identified as imports from sites outside the field of study. Possible sources include production sites on the Aegean Islands or in Sciliy and Southern Italy.

5.12 Comparison with Bronze Age Wares.

The Argolid was a centre of pottery production in the Bronze Age. To identify any compositional similarities between Bronze Age pottery and the later samples analysed in this project, two Bronze Age databases were included in the analysis.(ATT82, ASA74) These had examined the provenance of Early and Late Bronze Age pottery respectively. Both studies were standardised to the Perlman standard, hence direct comparison was possible. An earlier study at MUCD,(PAY92) which compared 13 elements, (Sc, Cr, Fe, Co, Rb, La, Ce, Eu, Yb, Lu, Hf, Ta, Th), identified some similarities between the two studies. Therefore suggesting that the composition of clay changed very little during the Bronze Age. The earlier study also identified dilution effects for the Bronze Age samples.

5.12.1 Early Bronze Age.(ATT82)

The PhD thesis by Michael Attas(ATT82) contained sherds from the Early Bronze Age. The sites analysed included Tiryns and Asine in the Argolid, and Korakou and Lake Vouliagmeni, a site near Perachora on the opposite side of the Bay of Corinth to Corinth. The latter site also included some sherds from the Mycenaean and Archaic periods.

Initially nine of the elements (Sc, Cr, Fe, Rb, La, Ce, Lu, Hf, Th) included in the earlier MUCD study(PAY92) were compared. Similar results were seen between the Attas Tiryns sherds and the Argive Black Glaze group. The means and standard deviations of the Attas Tiryns group contained an additional seven elements, (Na, Al, K, Ca, Ti, V, Mn). No associations were seen when the Black Glaze sherds were compared with this group using MAHALA. The major elemental differences(Table 5.36) between the two compositions were manganese, which was about double in later pottery, and thorium, which was low in the Bronze Age samples. The Attas Tiryns group showed no similarity to the Late Bronze Age sherds(PAY92).

Table 5.36

Comparison of Argive Compositions

	ATT82		**Argive Black Glaze**	
Na	1.06	0.12	0.71	0.10
Al	8.1	0.40	8.82	0.38
K	2.8	0.30	2.58	0.36
Ca	2.1	1.40	4.66	1.24
Sc	20.2	0.80	19.9	1.00
Ti	0.5	0.04	0.48	0.05
V	128	7.00	118	14.4
Cr	333	108	248	27.5
Mn	714	86.0	1248	46.5
Fe	5.1	0.20	5.20	0.35
Rb	123	25.0	130	14.6
Cs	6.4	1.00	6.58	0.85
La	38.1	3.80	39.4	4.22
Ce	79.8	8.00	76.7	7.03
Hf	5.7	0.80	5.47	0.45
Th	9.6	0.90	12.9	0.98

Analysis using the original ten elements also showed similarities between the Attas Asine samples and the Argive Black Glaze group, and Korakou with Corinth. However Attas's analyses had defined seven distinct compositions,(Table 5.37) giving the mean and standard deviations for seventeen elements. Using MAHALA the Black

Glaze sherds were compared with Attas's groups. The majority of the sherds were unassigned. This suggests that the initial similarities seen between Bronze Age and Black Glaze sherds were caused by the limited number of elements available. Increasing the volume of data caused the two styles to separate. This emphasises the usefulness of NAA, which can measure a large number of elements accurately to give more detailed compositional pictures.

Table 5.37

Early Bronze Age Compositional groups[(ATT82)]

M: Corinthian Plain.

N: Zygouries or the Corinthian Plain.

O: Keramidhaki, Corinthia.

P: Zygouries.

Q: Tiryns.

R: Asine.

S: Asine, includes mud bricks and modern clay.

Some associations were seen between Group N, thought to be from Zygouries or the Corinthian Plain, and sherds identified as Corinthian during the present project. This similarity was validated by the assignment of the members of the Corinthian group to Group N.[(Table 5.38)]

The comparison of the Lake Vouliagmeni sherds with Corinthian ware showed good similarities for 10 elements. Only one additional element, Ca, was identified. When this was included the sherds remained in good agreement.[(Table 5.39, Dendrogram 5.5)] The Vouliagmeni group contained Mycenaean, Archaic and some Early Helladic I

Table 5.38

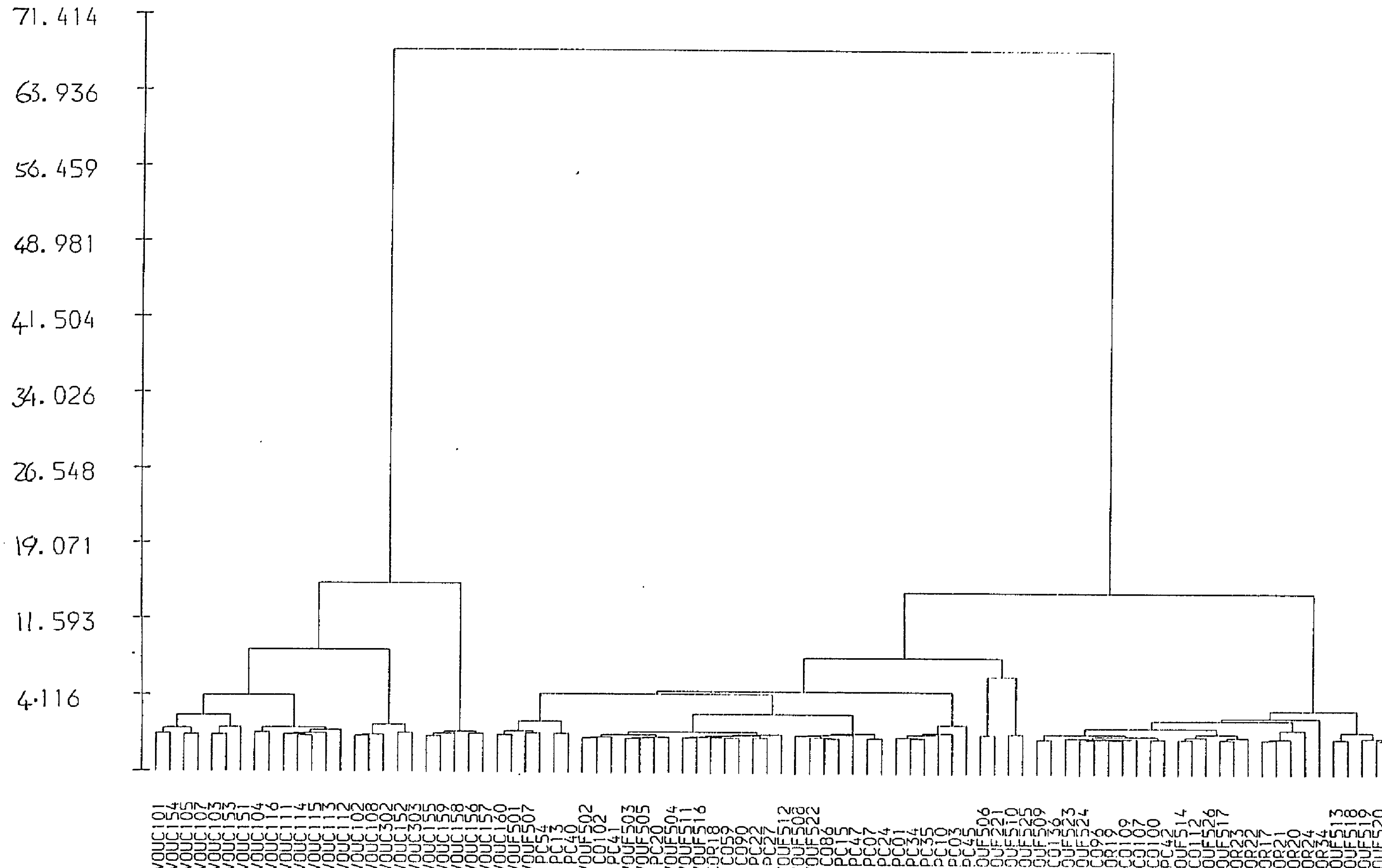
Comparison of Bronze Age and Black Glaze sherds.

SAMPLE	GROUP	M			N			O		
KRAK01	N	45.11	5	7	21.79	9	4	44.20	4	9
KRAK02	N	36.81	5	8	18.33	5	1	25.53	6	5
KRAK03	N	37.93	5	6	19.96	8	4	37.13	5	6
KRAK04	N	38.74	5	5	19.09	7	2	40.69	5	8
KRAK05	N	36.76	8	7	12.98	12	2	30.31	6	6
KRAK06	M	28.01	8	3	28.29	6	5	43.02	5	9
KRAK07	N	45.31	6	7	25.12	7	5	48.61	2	9
KRAK08	N	38.23	6	6	19.80	8	4	35.32	5	6
KRAK10	N	48.03	2	8	39.35	3	8	40.35	4	6
KRAK11	N	37.29	7	6	14.50	11	2	33.46	5	8
KRAK12	N	38.11	5	7	18.28	7	3	35.57	4	7
KRAK13	M	31.06	7	5	35.70	8	5	48.40	4	7
KRAK14	N	40.85	6	6	19.79	7	3	40.70	4	7
KRAK15	N	40.65	4	9	20.20	6	3	29.42	5	6
KRAK16	N	36.01	7	5	17.83	9	3	38.67	4	8
KRAK17	N	35.20	7	6	16.77	8	4	38.87	5	8
KRAK20	M	20.92	8	3	31.43	7	5	37.02	5	7
KRAK21	M	28.70	5	5	38.09	5	6	52.66	6	9
KRAK23	N	38.60	4	10	20.56	6	4	20.69	8	2
KRAK24	N	33.81	5	8	20.31	7	3	22.81	7	4
KRAK25	N	36.61	5	8	18.90	6	4	25.99	5	6
KRAK26	N	35.95	4	8	21.18	7	5	27.51	6	5
KRAK27	N	35.20	6	5	16.46	10	1	30.56	6	5
KRAK28	O	43.13	0	11	31.88	2	8	26.42	6	6
KRAK29	N	41.80	2	11	24.29	6	7	27.85	5	3
KRAK30	N	51.86	4	7	23.83	8	4	45.29	4	9
KRAK31	N	31.22	8	4	15.43	8	2	29.58	5	4
KRAK32	O	39.33	2	12	31.36	3	7	20.04	8	2
KRAK33	N	30.61	6	4	18.54	7	3	32.87	5	8
KRAK34	N	29.63	6	5	14.20	10	3	27.37	5	6
KRAK35	N	37.23	4	6	20.95	3	2	24.94	8	5
KRAK36	N	36.09	7	5	16.89	10	2	31.13	5	6
KRAK37	M	20.25	11	2	32.82	7	5	44.00	4	8
KRAK38	N	33.49	5	7	18.33	7	3	26.97	6	6
KRAK39	N	32.36	5	5	18.70	6	2	28.48	6	4
KRAK40	N	35.23	6	6	14.65	10	2	28.90	5	6
KRAK41	N	70.09	2	10	36.16	7	6	64.31	2	11
KRAK43	N	39.96	4	8	21.69	6	4	22.96	8	4
KRAK45	N	40.96	7	6	21.25	10	3	38.55	3	8
COR17	O	38.31	1	8	26.26	2	3	17.50	10	2
COR18	N	40.14	7	7	21.31	7	4	31.34	6	6
COR19	N	34.83	6	7	16.87	9	2	25.08	6	5
COR20	O	41.09	3	12	28.85	4	7	23.46	6	3
COR21	O	40.12	4	10	22.53	4	2	18.81	9	1
COR22	N	28.51	3	5	27.94	5	5	33.02	6	6
COR23	N	25.85	7	5	20.74	7	4	31.24	4	5
COR24	N	46.95	3	8	28.76	6	4	31.08	7	5
COR34	N	42.45	2	6	32.19	4	6	38.56	4	5
CO18	N	37.06	7	6	19.81	8	3	42.50	2	8

Table 5.38 cont.

SAMPLE	GROUP	M			N			O		
CO41	N	42.25	7	6	19.86	10	3	41.91	4	8
CO43	N	36.36	7	5	19.86	9	4	39.03	4	6
CO46	M	25.54	8	3	37.95	6	8	41.81	5	6
CO59	N	33.23	7	6	19.35	9	3	28.73	6	4
CO66	N	47.10	4	8	29.26	8	5	45.30	3	5
CO86	N	38.30	5	7	25.90	8	5	32.00	5	6
CO90	N	31.13	4	8	28.32	4	5	33.75	5	7
CO93	N	41.31	3	7	24.31	7	4	42.78	4	9
CO96	N	30.18	9	6	16.96	11	3	31.17	5	7
CO100	N	33.16	7	6	20.94	10	4	30.11	7	5
CO102	N	33.34	7	5	17.32	10	3	32.69	7	5
CO107	M	22.77	8	5	26.42	7	5	35.16	3	7
CO109	N	35.73	4	6	18.59	8	3	25.54	5	2
CO111	N	38.33	4	6	23.43	8	5	35.88	4	6
CO112	O	40.87	3	9	24.26	6	4	23.74	8	5
CO136	N	28.45	8	5	15.05	10	2	29.12	6	6
CO139	N	49.29	6	8	27.33	7	5	50.36	4	10
CO140	N	34.84	7	6	19.67	8	3	39.44	6	8
CO142	N	39.00	5	6	20.50	9	4	40.59	6	8
PC01	N	36.91	5	5	21.85	6	4	41.82	2	9
PC03	N	68.41	2	12	40.61	4	9	58.34	2	11
PC07	N	35.09	7	6	18.28	9	3	43.28	2	9
PC10	N	41.85	6	6	20.64	9	4	53.09	0	9
PC13	M	35.46	5	6	38.52	5	9	44.78	4	8
PC15	N	40.93	5	6	20.44	7	4	40.82	3	8
PC16	N	37.90	4	6	24.69	4	4	33.56	4	7
PC20	N	41.60	5	5	20.94	8	3	44.89	3	9
PC22	N	31.17	8	5	15.31	10	2	33.07	4	5
PC24	N	43.38	5	6	23.08	8	5	47.95	2	8
PC27	N	34.04	7	4	20.97	9	4	40.78	1	8
PC34	N	38.20	6	5	19.62	9	4	45.24	3	7
PC35	N	37.09	7	5	18.18	9	2	41.25	2	8
PC40	M	32.17	6	3	46.00	5	8	60.68	1	10
PC41	N	39.22	6	6	24.25	7	5	51.22	1	10
PC42	N	34.86	5	8	23.48	7	5	28.24	4	5
PC45	N	32.72	7	5	23.15	8	3	39.19	3	9
PC47	N	41.16	4	5	26.54	7	4	43.44	2	7
PC54	M	29.44	8	4	41.11	6	9	49.66	3	6

Key: **KRAK:** Korakou Late Bronze Age sherds.
CO/COR/PC: Corinthian ware found at Corinth and Perachora.
M: Corinthian Plain source for Early Bronze Age sherds.
N: Zygouries or Corinthian Plain ""
O: Keramidhaki, Corinthia ""



Dendrogram 5.5 Lake Vouliagmeni, (VOU), Corinth, (CO) and Perachora, (PC).

sherds. This suggests that the group originated from across the Gulf of Corinth at Corinth. An earlier study(ATT77) found good agreement with this group and a group containing Mycenaean pottery excavated at Mycenae.(KAR72) However no conclusion about the origin of the Mycenaean pottery has been made.

Table 5.39

Comparison of Lake Vouliagmeni and Corinth Compositions.

	ATT77		Corinth BG	
Element	**Mean**	**SD**	**Mean**	**SD**
Ca	7.70	4.8	10.7	1.83
Sc	21.8	3.0	23.1	2.02
Cr	286	87	256	25.3
Fe	5.52	0.6	5.86	0.51
Rb	127	40	144	18.4
Cs	9.10	4.8	9.45	1.00
La	34.0	2.9	33.8	2.25
Ce	64.1	6.1	61.8	5.39
Lu	0.40	0.03	0.41	0.04
Hf	3.94	0.7	3.35	0.45
Th	11.6	0.9	11.6	0.60

MAHALA was repeated to compare the Handmade wares from the Argolid and Corinthia with the Early Bronze Age groups.(Table 5.40) The Argive Handmade ware group and OM5B, a group containing Argive Monochrome ware sherds from Tiryns, were isolated. Some members of OM2, an unassigned group consisting of sherds excavated at Tiryns, were assigned to Group S, which included modern clays and mud bricks from Asine. However, comparing the means and standard deviations of the two groups highlighted a major discrepancy between the calcium concentrations. OM2 had a very low calcium content. The Handmade wares from Corinth corresponded with Group N, further emphasising the similarity of Corinthian sources. These associations suggest that Group N is a Corinthian Plain source rather than

Table 5.40

Comparison of Bronze Age and Handmade Ware.

Sherd	Group	N			S		
OM101	N	20.40	9	4	59.32	1	12
OM102	N	31.08	6	6	75.47	1	11
OM103	N	24.13	7	4	64.54	2	12
OM104	N	24.32	8	2	65.56	1	11
OM105	N	18.09	9	3	56.15	3	12
OM18B	N	20.88	8	3	64.93	1	10
OM109	N	17.63	10	3	51.21	2	10
OM110	N	14.46	11	2	51.58	2	11
OM111	N	25.01	7	5	69.70	2	12
OM112	N	12.96	13	1	54.82	2	11
OM2A01	S	42.69	1	12	20.17	9	4
OM2A02	S	38.83	1	10	25.56	6	6
OM2A03	S	44.13	1	12	18.53	10	3
OM2A04	S	43.80	2	12	18.46	10	3
OM2A05	S	43.23	0	10	21.85	9	4
OM2A06	S	54.72	0	14	20.09	10	3
OM2A11	S	44.26	1	13	28.15	7	6
OM2A12	S	45.12	1	13	30.72	7	7
OM2B01	S	52.11	1	12	15.23	11	2
OM2B02	S	44.15	0	11	30.44	6	5
OM2B03	S	52.71	0	14	20.56	10	3
OM2B04	S	53.22	0	13	15.77	11	2
OM2B11	S	42.32	1	11	20.63	8	3
OM2B12	S	49.12	0	13	19.85	10	3
OM2B13	S	47.58	0	14	22.48	8	4
OM2B14	S	51.61	2	12	21.67	7	2
OM2B15	S	44.83	1	12	24.20	8	3
OM2B16	S	51.55	2	12	14.47	10	1
OM2C03	S	46.91	2	10	19.96	7	3
OM2C04	S	42.56	1	11	23.47	7	3
OM2C05	S	46.72	2	13	17.93	8	3
OM2C06	S	50.01	1	13	22.17	8	3
OM2C07	S	42.07	1	11	19.75	8	3
OM2C08	S	42.31	2	11	19.35	9	3
NTH05	N	27.21	9	5	60.83	2	12
NTH07	N	26.35	7	6	53.85	2	9
NTH09	N	17.36	10	2	61.48	2	11
NTH10	N	18.10	11	4	57.00	1	11
NTH11	N	20.07	8	4	42.95	3	9
NTH12	N	17.92	12	2	54.13	2	11

KEY: **OM1, NTH:** Corinthian Handmade ware sherds
OM2A, B, C: Argive Handmade ware sherds of unknown origin
N: The Corinthian Plain or Zygouries Early BA sherds
S: Asine, including mud bricks "

originating from Zygouries.

5.12.2 Late Bronze Age.

The Perlman database included results for Late Bronze Age pottery from sites in the Argolid and Corinthia. Five sites were compatible with the present study. These were Mycenae, Berbati, Tiryns, Asine and Korakou, a Bronze Age site close to Corinth.

The Tiryns samples from the Perlman database had been divided into two groups. One, TIR1, was thought to contain local pottery, the other, TIR2, samples from Mycenae. Comparing the Bronze Age and Black Glaze Tiryns samples produced two groups. Of these one contained all the Argive Black Glaze sherds, suggesting a different fabric was used in later periods. After this group was removed three clusters remained.

1:TIR3-9,11-18,20,21,27-31,35,38,43,45 and T5/3,6/1

2:TIR2,19,22-24,32-34,36,39,40,42,44 and T13/2,3

3:T1/2,4/1,2,5/1,6/2,7/2,8/1,12/2,15/3

Group 1 was similar to one of the previously identified Tiryns Bronze Age groups, TIR2. It included two Black Glaze sherds which had been identified as Corinthian. Group 2 was comprised of the local sherds from the Tiryns Bronze Age group TIR1 and the Argive Geometric pottery from the present study. The final group contained the Athenian Black Glaze group, suggesting this was also of a different fabric.

Cluster analysis was used to compare the Tiryns Bronze Age samples with the Corinthian ware to check the similarities suggested by the above results. The results were inconclusive and the two Tiryns Bronze Age groups were obscured. As the Corinthian ware is known to be affected by dilution, the analysis was repeated using the FACTOR program. This produced three clusters; the two Bronze Age groups and the Corinthian sherds.[Figure 5.8] The Bronze Age and Black Glaze wares had separated, showing the similarities seen between the Tiryns samples were artifial due to dilution effects.

Further investigation was made of the apparent similarity of Argive Geometric pottery and the Tiryns Bronze Age sherds, observed in Group 2 above. Initially, a mixed result was obtained with the Argive Geometric samples mixing with the local Tiryns Bronze Age group, TIR1. But, the FACTOR program, again separated these groups, showing that the apparent similarities were due to dilution.[Figure 5.9]

Comparison continued with the Bronze Age sherds from Mycenae. Again the Argive Black Glaze sherds were separate, suggesting different clay sources were used.[Appendix 4,D10] On the removal of this group a slight similarity was seen between the Bronze Age and Argive Geometric samples. Correcting for dilution separated the styles.[Appendix 4,D11]

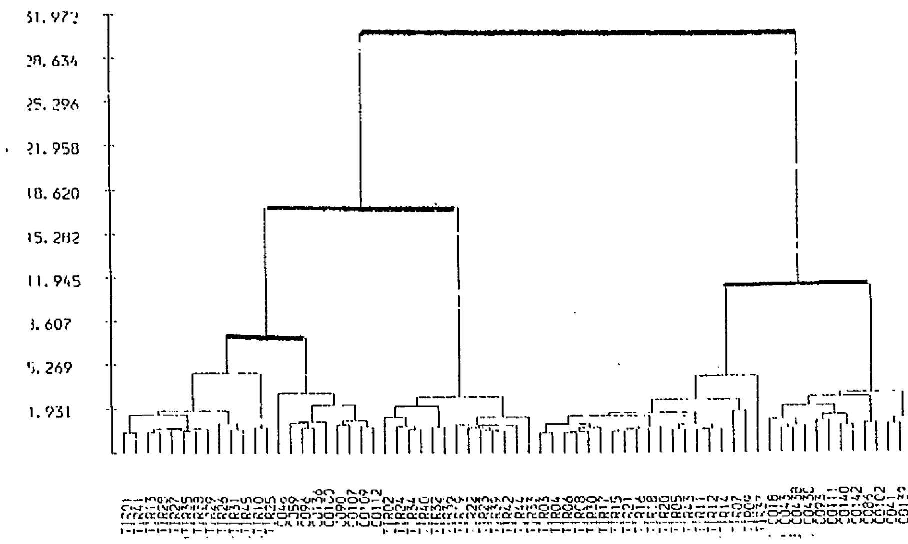
Further analyses showed no relationship between the Bronze Age samples and Black Glaze samples from Berbati[Appendix 4,D12,13] and Asine[Appendix 4,D14,15] after dilution corrections. The Korakou samples did associate with the Attas Group N, as did the Corinthian ware from the present study. However, the Archaic sherds from Corinth and the Late Bronze Age sherds from Korakou separated after dilution corrections.[Dendrogram 5.6] This suggests that the three wares are actually separate, and any associations were artifial due to dilution effects. These results indicate that a single Corinthian source was not used throughout antiquity as suggested by the similarity of Handmade wares and Black Glaze sherds.

The comparison of the Perlman samples with the Handmade ware groups

Figure 5.8

Comparison of Tiryns Late Bronze Age and Corinth.

Tiryns and Corinth.

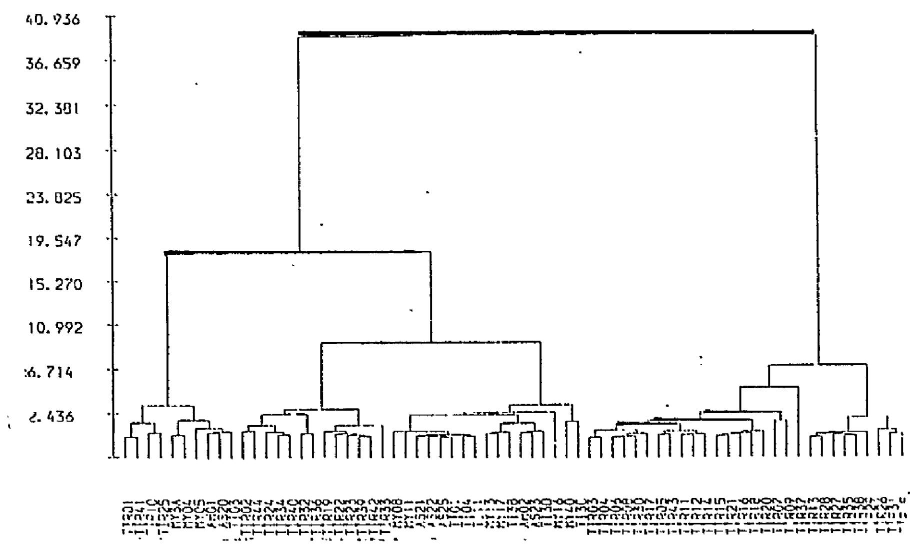


Tiryns and Corinth Dilution Corrected.

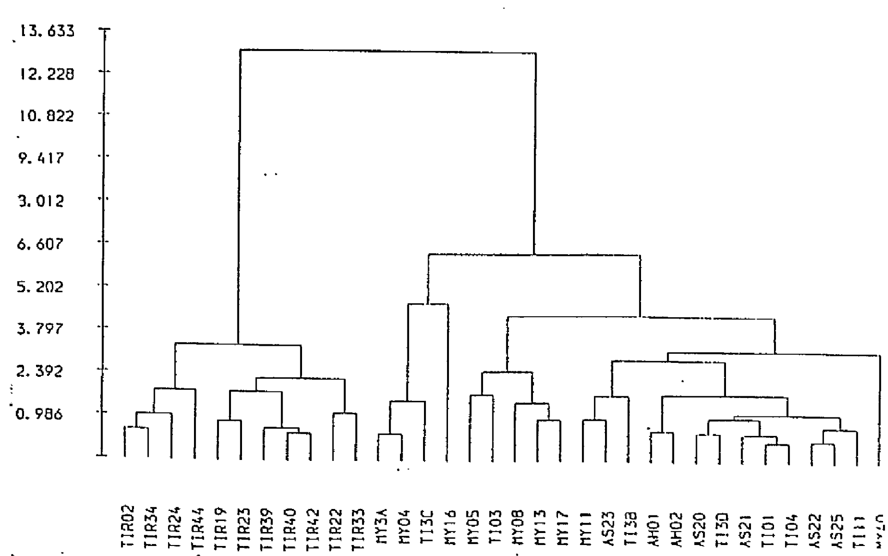
Figure 5.9

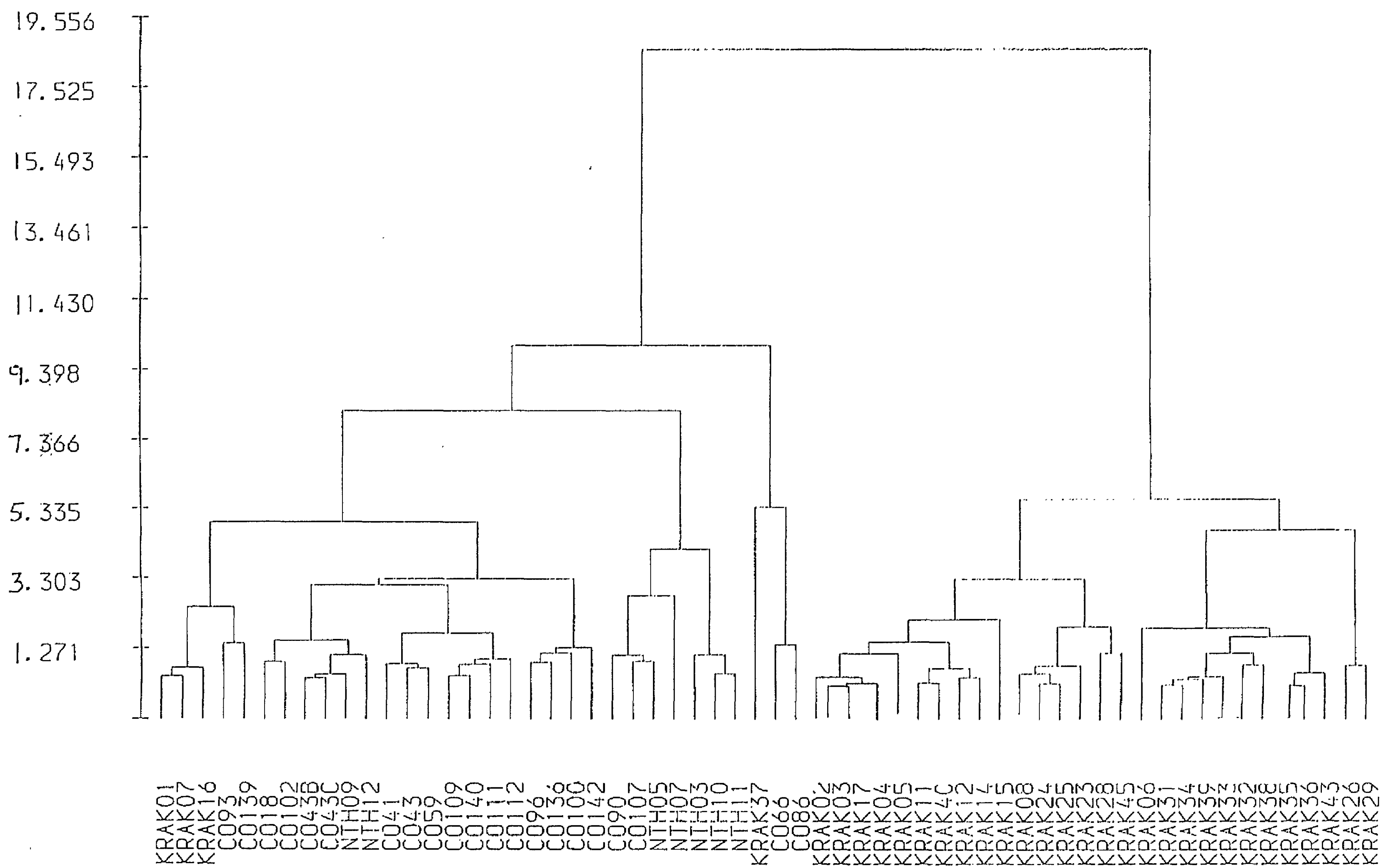
Comparison of Tiryns Late Bronze Age and Argive Geometric.

Tiryns and Argive Geometric.



Tiryns and Argive Geometric Dilution Corrected.





Dendrogram 5.6 Korakou, (Bronze Age), (KRAK) and Corinth, (CO).

produced two groups.(Appendix 4,D16) TIR1 with OM5B, a group of Argive Monochrome sherds found at Tiryns. OM5B had shown slight similarities with Argive Geometric pottery in earlier analyses, but had remained unassigned. TIR2 associated with the Corinthian group. No associations were seen between the Argive Handmade ware and OM2, a group of Handmade ware sherds characterised by a very low calcium concentration. The presence of dilution effects were identified when TIR1 and OM5B separated after dilution corrections. This was also seen for TIR2 and Corinthian Handmade wares.

5.11.3 Discussion.(Table 5.41)

Comparing the sherds from the present study with Early and Late Bronze Age sherds has shown no similarities between the differing styles within the Argolid. This indicates that various sources of clay were utilised within the Argolid during antiquity. A similar result was obtained for sherds from Corinthia, with the exception of a group of sherds from Lake Vouliagmeni. These included a number of Archaic sherds, whose inclusion caused the group's composition to appear close to the Corinthian group from the present study.

The results from the comparison with Early Bronze Age sherds initially produced a false picture, due to a limited number of elements. This was resolved by the addition of a further seven elements, and highlights the need to measure a large number of elements. The Late Bronze Age comparison showed the value of checking for possible dilution effects. Initially, Corinthian and Argive Geometric sherds associated with the Bronze Age sherds. However, after dilution corrections these sherds formed disparate groups.

Comparing the two Tiryns Late Bronze Age groups highlights differences between clays from the North, TIR2, and South Argolid, TIR1.(Table 5.42) The northern

Table 5.41 **Summary of the Bronze Age Comparisons.**

Classical Ware	Bronze Age Ware	Cluster Analysis	Dilution Corrected
Argive BG	EBA Tiryns[(ATT82)]	Separated due to Mn and Th.	-
Argive BG	EBA Asine[(ATT82)]	Separated.	-
Corinthian Group	Gp N: Corinthian[(ATT82)]	Associated by MAHALA.	
Corinthian Group	Lake Vouliagmeni[(ATT82)]	Very similar due to the presence of Archaic pottery in EBA group.	-
OM2	Gp S: Asine[(ATT82)]	Separated due Ca.	-
Argive BG, Athenian	Tiryns LBA	Separated.	-
Argive Geometric	TIR 2, (local)	Similar.	Separated suggesting dilution
Corinthian Group	TIR 1, (Mycenaean)	Muddled picture.	Clear separation of groups
Berbati BG	Berbati LBA	"	"
Corinthian Group	Asine LBA	"	"
Corinthian Group	Korakou LBA	Assigned by MAHALA.	Separated suggesting dilution
Argive HW, OM2	Tiryns LBA	Separated	-
OM5B	TIR 1, (Mycenaean)	Slight similarities.	Clear separation of groups

Table 5.42

The Compositions of the Tiryns Bronze Age Groups.

Tir 1: Southern Group.

Element	Mean	SD	%
Na%	1.323	0.34	25.84
Al%	8.19	0.40	4.89
K%	2.08	0.44	21.28
Ca%	8.95	1.01	11.35
Sc	20.4	0.94	4.62
Ti%	0.463	0.02	5.16
Cr	200	19.0	9.50
Mn	1001	78.9	7.88
Fe%	5.33	0.26	5.05
Rb	111	20.1	18.04
Cs	5.15	0.45	8.84
La	31.9	1.20	3.77
Ce	65.5	2.53	3.88
Dy	5.17	0.50	9.67
Lu	0.417	0.03	7.19
Hf	4.27	0.44	10.29
Th	11.1	0.47	4.32
U	2.17	0.07	3.30

TIR 2: Northern Group.

Element	Mean	SD	%
Na%	0.545	0.16	30.65
Al%	8.55	0.56	6.56
K%	2.66	0.40	15.08
Ca%	9.41	1.25	13.28
Sc	21.7	1.66	7.65
Ti%	0.447	0.03	8.09
Cr	244	19.7	8.07
Mn	943	88.6	9.40
Fe%	5.43	0.29	5.40
Rb	160	22.0	13.71
Cs	9.43	1.61	17.12
La	32.1	1.81	5.65
Ce	62.9	3.91	6.21
Dy	4.51	0.21	4.65
Lu	0.403	0.02	5.46
Hf	3.61	0.36	10.00
Th	11.1	0.67	6.05
U	2.37	0.17	7.18

clay has low sodium and high rubidium and caesium concentrations, while both clays have similarly high calcium contents. This pattern was also detected by Mommsen.(MOM88) Similar patterns differentiate between the Corinthian and Argive Geometric groups identified during this study, hence implying a Southern Argolid source for the Argive Geometric sherds. The Argive Black Glaze group contains a high proportion of sodium as seen for southern sources, but has a much lower calcium content, and a very high manganese concentration. The latter concentration was large compared to all the Black Glaze groups identified, suggesting that it was not caused by Mn oxides in the glaze permeating into the clay. This suggests different sources for the Argive Geometric and Black Glaze, as seen by cluster analysis. The large volume of calcium in Corinthian clay causes an inferior gloss.(FAR63) Consequently, Classical Argive potters may have changed to a less calcareous clay to achieve a quality glaze.

In summary these results suggest that the Late Bronze Age pottery samples were subject to dilution effects, and any similarities seen between the various styles were the result of this. These variations may be due to slight changes in the composition of clay through time. The results suggest a calcareous source rich in feldspars (high Rb and Cs) in the North Argolid and Corinthia, and a calcareous source with a low concentration of feldspar in the south. During the sixth century BC the southern source was changed to provide a low calcium source, characterized by a high manganese content, for Black Glaze production.

5.13 Laboratory Comparisons.

During the Archaic and Classical periods Athens and Corinth were among the major pottery producers in Greece. Due to the abundance of pottery from these sites, they have been widely studied by chemical analysis. The inclusion of these sites in the present study has allowed the comparison of different laboratories and analytical techniques.

5.13.1 Athenian Comparisons.

There have been seven studies of the provenance of Black Glaze ware which have published the mean concentration data for an Attic group. The earliest composition was defined by wet chemical techniques.(RIC1895) Of the eight oxides determined there were five in common with this project. Converting the concentrations to elemental data gave similar results to those found by modern analytical techniques.(Table 5.43) These include two studies by NAA,(WOL86, FIL83) two using OES,(PRA74,BOA73) and two using AAS(HAT80, LEM91).

Table 5.43

Attic Compositions

element	RIC1895	Attic BG
Na	0.623	0.563
K	2.323	3.003
Al	9.079	9.156
Ca	4.309	4.028
Fe	6.048	6.057

One of the NAA studies(WOL86) had been carried out at MUCD, as the same standards had been used direct comparison of the data was possible.(Table 5.44)

The results show that the concentrations produced at MUCD are consistent for two sets of pottery from the Athenian Agora. Hence it is viable for the MUCD data to be compared when useful.

Table 5.44

The Comparison Of MUCD Attic Data.

Element	Wolff Data		Scott Data	
Na%	0.41	0.03	0.56	0.06
K%	3.27	0.15	3.00	0.29
Sc	23.4	1.81	24.0	1.91
Fe%	5.79	0.16	6.06	0.25
Rb	153	14.3	159	12.5
Cs	12.5	1.19	13.4	1.41
La	34.9	1.30	34.0	2.94
Th	11.4	1.45	12.9	2.00
U	2.18	0.16	2.20	0.31

The other NAA study(FIL83) was carried out at the Brookhaven National Laboratory. This laboratory uses a different method of standardisation to the Perlman standard to which MUCD is calibrated. Brookhaven use six geological samples, (United States Geological Standards, USGS). Therefore direct comparisons of the data could only highlight trends within each data set.

However researchers at Brookhaven(YEH86) analysed the Perlman standard, with their standards, and have devised a conversion chart(Table 5.45) to allow the comparison of their data with Perlman data. Hence the data for the Fillieres *et al* Attic group was converted for comparison.(Table 5.46)

The results were encouraging: all the concentrations were within one standard deviation, with the exception of potassium which was a less reliable element. Therefore with the use of conversion charts inter laboratory comparisons are achievable. To test this further two sets of suspected Attic sherds from Idalion, Cyprus and Tell El Hesi, Israel, analysed at Brookhaven,(BIE76) were converted to the Perlman standard. Both groups were confirmed as Attic ware fitting with both sets of Athenian concentrations.(Figure 5.8, Table 5.46)

Table 5.45

The Brookhaven Conversion Chart.[YEH86]

Element.	Conversion Factor,K.
NA	1.340
K	1.164
SC	1.611
CR	1.299
MN	1.339
FE	1.437
RB	0.988
CS	1.050
LA	1.240
CE	1.215
HF	0.998
TH	1.161

$$\frac{\text{BROOKHAVEN}}{\text{K}} = \text{PERLMAN}$$

The two OES analyses were performed at Oxford by Dr F.Schweiser. One of these studies[PRA74] included the recalibration of the Oxford system to the USG standards used at Brookhaven. Hence the conversion could be applied to this data for direct comparison.[Table 5.47] Unfortunately OES only measured nine elements, hence reducing the range of concentrations. This was further reduced as only four elements were included in the conversion chart. Obviously the comparison was limited, but the general trend was similar to the NAA data, high chromium concentrations. Unfortunately the OES data was not within the standard deviation of the NAA data, however because of the greater spread of the OES data the present results are consistent with the OES results.

Table 5.46

Comparison of Athenian Groups.

Element	This Project		FIL83		BIE76	
	Means	SDs	Means	SDs	Idalion	Hesi
Na%	0.563	0.060	0.560	0.097	0.555	0.572
K%	3.003	0.295	2.887	0.223	2.689	2.869
Sc	24.09	1.906	22.91	1.738	23.15	23.59
Cr	567.1	49.78	564.3	49.27	579.7	575.8
Mn	794.0	106.1	784.2	119.5	768.5	780.4
Fe%	6.057	0.246	5.706	0.418	5.755	5.880
Rb	159.5	12.55	163.9	15.18	168.9	167.1
Cs	13.48	1.406	12.00	1.619	11.88	11.78
Ce	72.40	4.222	77.37	6.580	81.40	78.85
Hf	4.043	0.464	4.259	0.350	4.489	4.088
Th	12.93	2.003	11.46	0.775	12.07	11.74

Figure 5.10

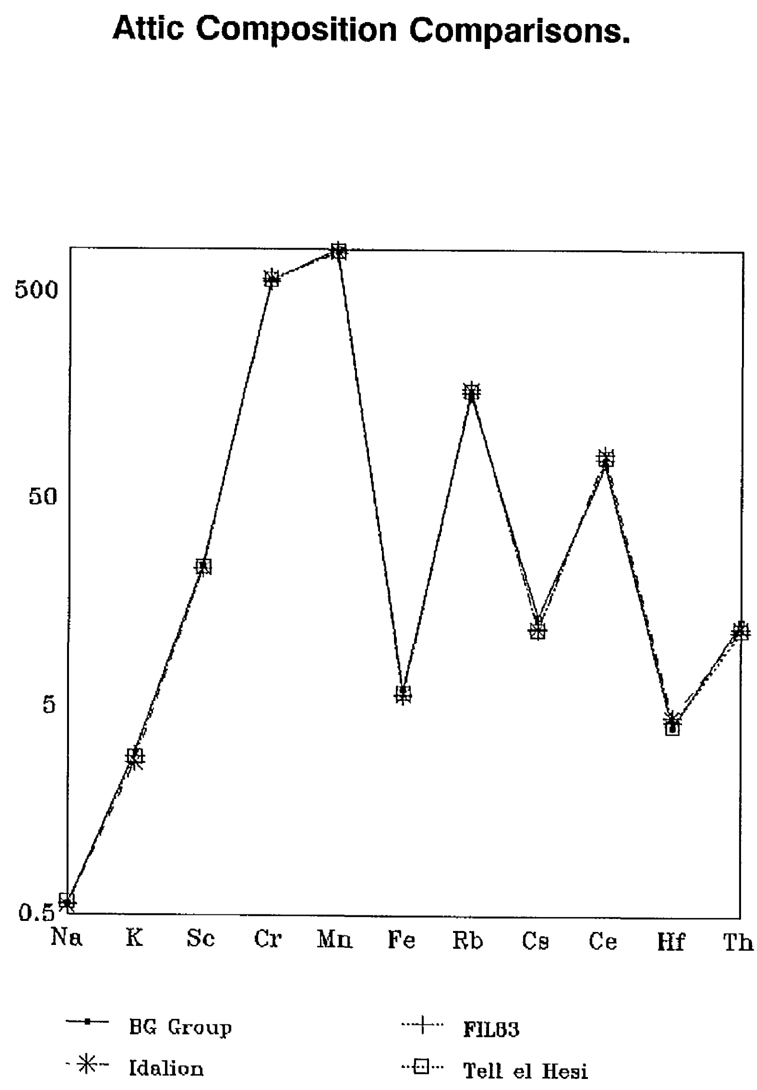

Attic Composition Comparisons.
500
50
5
0.5
Na
K
Sc
Cr
Mn
Fe
Rb
Cs
Ce
Hf
Th
BG Group
Idalion
FIL83
Tell el Hesi

Table 5.47

Comparison of NAA and OES Data.

	OES				NAA	
Element	**PRA74**		**BOA73**		**Athens**	
Na%	0.687	0.11	0.709	0.13	0.564	0.06
Fe%	8.21	2.78	5.08	1.39	6.05	0.24
Cr	500	84.7	523	123	567	49.7
Mn	716	119	627	112	793	106

One sample, POT35 included in the Boardman OES project(BOA73), was renamed POT09 for this study. This had been described as Euboean by Von Bothmer(VON69). However OES suggested it was actually Athenian. NAA confirmed the latter result.(Table 5.48) Though only four elements were compatible, and there were errors of 10% between the samples, the Attic composition was detectable, (high Cr).

Table 5.48

Comparison of POT09 Compositions.

	BOA73	POT09	Mean	SD	%
Na	0.709	0.592	0.651	0.06	8
Cr	460.0	550.0	510.0	45.0	8
Mn	550.0	660.0	610.0	55.0	9
Fe	7.655	6.264	6.959	6.95	10

Finally the AAS studies(HAT80, LEM91) used different standardisation methods than both the Perlman or USGS systems. This meant direct comparisons were not possible. However, the general trends were again the same, high chromium concentrations.

5.13.3 Corinthian Comparisons.[Table 5.49]

Three previous studies included the mean concentration data for a Corinthian ware group. One study was performed by Perlman,[FAR77] and used the same standardisation as the present study. Comparing the data showed good similarities, with both groups within the standard deviations of the other and containing the characteristic 10% calcium content.[Figure 5.11]

The Fillieres *et al*[FIL83] study examined Corinthian pottery as well as Attic pottery. The results were in good correspondence with the Perlman and Corinth Black Glaze groups.[Figure 5.12] These results was not as encouraging as those for Athens, however this maybe due to the dilution effects caused by a high calcium content. Both the Fillieres *et al* and Black Glaze groups had approximately 10% calcium.

Finally an investigation into the origin of the "Thapsos" class[GRI80] identified the source as Corinth. The results were again comparable with the Corinth Black Glaze showing the range of Corinthian wares, ("Thapsos", Protocorinthian, Black Glaze).

5.13.4 Euboean Comparisons

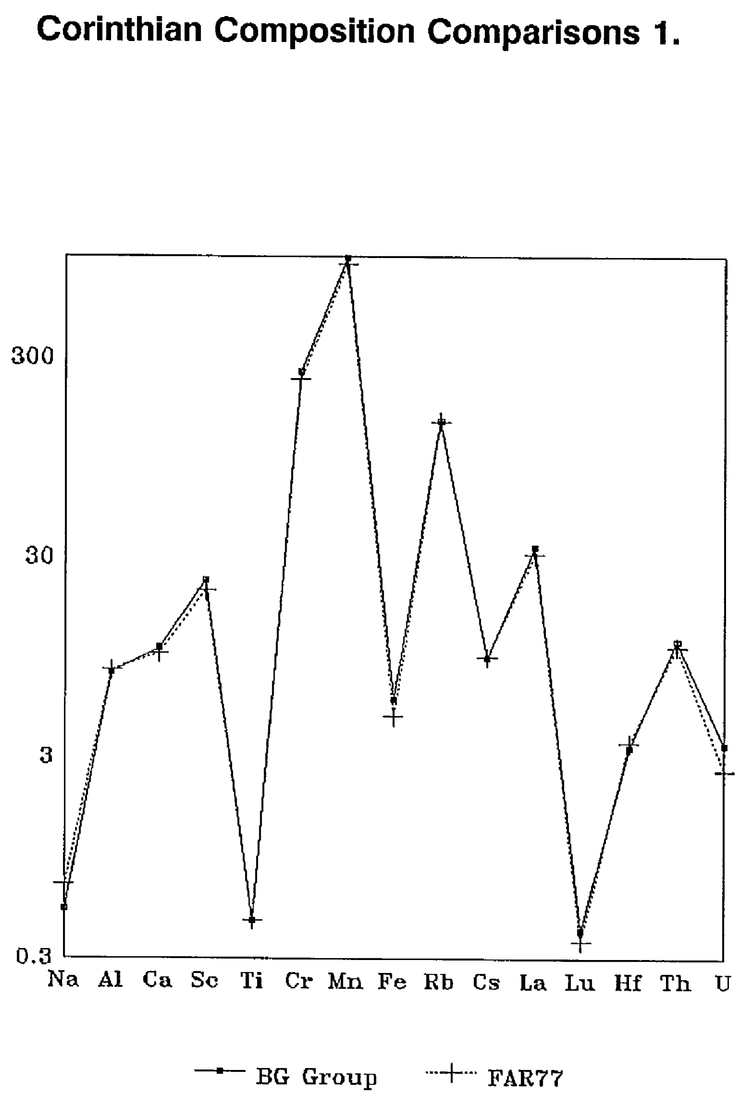
Three studies have investigated the pottery production on the island of Euboea. Like this study, all the previous studies could not distinguish between the major cities of Chalkis and Eretria. Consequently, the results discussed are for a "Central Euboean" Source.

One study was carried out by OES[BOA73] using the Brookhaven standards. Only three elements were in common, after converting the data the results were poor, particularly for chromium.[Table 5.50]

Table 5.49 Corinthian Group Comparisons.

Element	This Project		FIL83		FAR77		GRI80	
	Means	SDs	Means	SDs	Means	SDs	ProtoCor	Thapsos
Na%	0.527	0.122	0.5820	0.224	0.696	0.279	0.620	0.840
Al%	8.035	0.702	-	-	8.230	0.450	-	-
K%	2.205	0.379	2.3540	0.369	-	-	-	-
Ca%	10.70	1.833	-	-	10.00	2.100	-	-
Sc	23.07	2.027	18.436	2.855	20.68	1.090	26.50	24.70
Ti%	0.461	0.056	-	-	0.464	0.035	-	-
Cr	256.3	25.31	314.09	66.05	234.0	17.00	189.0	167.0
Mn	949.9	94.07	918.60	186.7	881.0	97.00	-	-
Fe%	5.868	0.515	4.8020	0.557	5.320	0.280	5.460	4.790
Rb	144.6	18.48	123.48	22.27	143.0	23.00	139.0	123.0
Cs	9.451	1.006	7.4290	1.143	9.600	2.100	8.900	8.870
La	33.83	2.251	30.726	3.387	31.00	2.300	47.20	45.50
Ce	61.83	5.392	66.667	7.407	-	-	88.00	81.11
Lu	0.413	0.0486	-	-	0.366	0.018	0.340	0.340
Hf	3.352	0.4544	4.5048	0.420	3.520	0.310	2.720	2.340
Th	11.60	0.9166	10.949	1.378	10.84	0.620	11.40	9.360
U	3.436	0.6057	-	-	2.560	0.650	-	-

Figure 5.11



Corinthian Composition Comparisons 1.
300
30
3
0.3
Na
Al
Ca
Sc
Ti
Cr
Mn
Fe
Rb
Cs
La
Lu
Hf
Th
U
BG Group
FAR77

Figure 5.12

Corinthian Composition Comparisons 2.

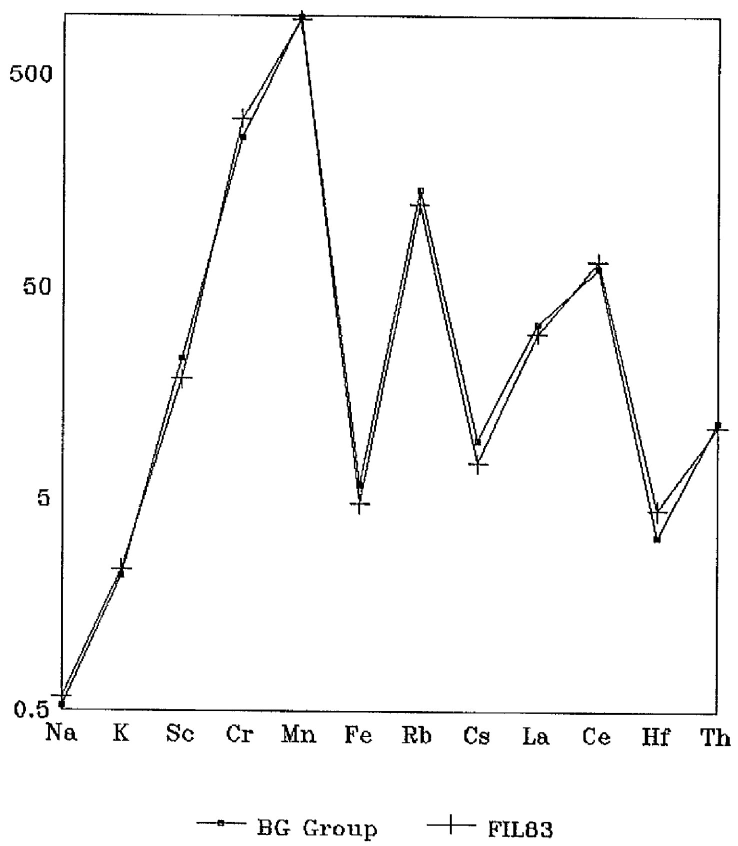


Table 5.50

Euboean comparisons.

Element	OES	NAA
Na	0.918	0.951
Cr	642.5	182.6
Fe	5.706	5.662

The two other studies were performed by AAS.(POP83,LEM91) Both of these used different standards than MUCD or Brookhaven. Hence only the general trends of the respective groups can be noted.(Table 5.51)

These comparisons were very encouraging, showing the Euboean characteristics of high Na, Al and low Cr.

Table 5.51

The Characteristics of the Central Euboean Source.

	AAS		NAA
	POP88	**LEM91**	**Euboean BG**
Na	0.987	0.972	0.951
Al	10.57	11.13	10.66
K	2.888	3.220	3.660
Ca	3.256	3.633	3.346
Ti	0.450	0.528	0.486
Cr	171.1	225.8	182.6
Mn	976.1	1076	947.6
Fe	5.250	5.607	5.660

5.12.5 Discussion.

The Attic, Corinthian and Euboean compositions defined by the present study are in good agreement with the compositions produced in previous analyses. The best results were achieved for NAA comparisons, illustrating the accuracy of the technique.

The poorest results were seen for comparisons with OES.

The Attic compositions for seven different analyses including the present study were very similar, highlighting the uniformity of Attic clay. This uniformity was not seen for the Corinthian pottery, though the compositions were similar. The means and standard deviations of Corinthian groups were not corrected for dilution effects, hence the slight differences in composition could be due to dilution effects caused by a large calcium content.

Although the AAS results for Euboea could not be directly compared with the present study, they did verify the results obtained. A central Euboean source with a large aluminium concentration was identified in all three analyses.

Chapter 6:

Summary and Conclusions.

Summary and Conclusions.

6.1 Scientific Conclusions.

The process of analysing approximately 800 sherds and comparing these results with Bronze Age databases and alternative laboratory analyses led to several scientific conclusions.

1: It is important to be able to measure elemental data more precisely than the typical spreads expected for a single source. If this is not achieved the variance for a single element would be greater than the variation of that element within a group. This would make the results unreliable.

To assess the precision of this analysis, a selection of sherds were multiply sampled. The results showed a precision of less than 5% for the majority of the twenty-four elements measured. This is below the typical standard deviation expected for a single source, approximately 10%. Hence, the results of statistical analysis would be expected to yield reliable group assignments.

2: The results from three earlier studies of Black Glaze ware at MUCD[BUR86,TOM88,FOY90] were included in this project. These studies had only measured the long-lived elements. To increase the number of elements available, the short irradiation cycle was performed for all the samples. In addition the long irradiations were repeated for a selection of the sherds.

Comparing the new and the old data gave a precision of better than 5% for the elements measured, with the exception of Yb. This was consistently higher for the second irradiation, producing errors in the order of 50%. Clearly ytterbium could not be included in the statistical analysis without the possibility of sherds grouping by their ytterbium concentration alone. Consequently Yb was removed before multivariate analysis began.

3: Two sampling procedures were employed during this project. The majority of the sherds were clipped and ground to a fine powder. However, some samples were too small or delicate for this approach. In this case a sample was taken by drilling with a diamond tipped drill bit. This could lead to the contamination of a sample by the drill bit. To estimate the extent of this contamination a couple of sherds were sampled by both methods. The results showed that using different methods of sampling gave a negligible contribution to the overall experimental error.

4: During the period of this project the irradiations were performed at two reactors. To check that the results remained consistent between the two reactors, the multiple samples of five sherds, which had been irradiated at URR, Risley, were irradiated at ICRC, Ascot. The elemental concentrations for each multiple sample were in good agreement with its parent's composition. A poorer result was seen for uranium, this was improved by measuring the uranium concentration from the short irradiation. As the irradiations from the two reactors produced corresponding results, these could be combined for statistical analysis.

5: The errors incurred by weighing the samples were found to be negligible.

6: Two irradiations were performed for the present study; a short and long irradiation. If neutron flux variations had affected the samples during these irradiations, the concentrations measured during each irradiation would be raised or lowered by the same factor. The effect of neutron flux variations at URR was investigated in earlier studies and found to be negligible.[(COL86)] No relationship was seen between the two long-lived counts from ICRC irradiations. Therefore the errors caused by flux variations, at ICRC, are also negligible.

7: Statistical analysis of the results of this study determined fourteen distinct fabrics. The variations within a group ranged from 6% to 20%. The larger deviations were seen for less reliable elements, such as K or U, or elements effected by internal variances, such as Ca or Mn. The latter problem could be corrected for by the FACTOR program.

8: The majority of the sherds analysed during this project were assigned to groups, hence identifying their origins. This highlights the uniformity of the fourteen defined fabrics, and the precision of NAA as a provenancing tool. This was particularly obvious for the provenance of twenty-five display pieces from Manchester Museum. Using the Black Glaze database the origins of 12 vases were identified. The unassigned vases had been thought to originate from non-Greek sites. This was confirmed by their dissimilarity to Greek compositions within the database.

Approximately 6% of the sherds analysed during this project did not associate with a particular group. The outlying nature of a number of these sherds was caused by irregular concentrations for an individual element. By removing the anomolous concentrations before analysis, a number of these sherds have been assigned to particular groups.[(Appendix 3)] The majority of the unassigned sherds were outliers because of differing compositions. The origin of these remains unidentified. However, this project has eliminated the major cities on the Greek mainland as possible places of origin. To rectify this problem the area of interest needs to be increased to include sites outside the Greek mainland.

9: During statistical analysis various elemental correlations were identified. These did not effect group definition, hence correctional procedures were not required. However, dilution effects were observed particularly during the analysis of Corinthian pottery. Corinthian pottery contained a large amount of calcium, suggesting a large volume of limestone is present in the clay. Limestone contains very few trace elements and therefore acts as a diluent when present in large quantities. By correcting for dilution, using FACTOR, the true representation of a set of sherds can be detected. In the analysis of Corinth this produced a single group, when initially two clusters were observed. Furthermore the analysis of Protocorinthian sherds from Perachora initially produced misleading results, suggesting Athens as a possible source for a number of the sherds. This is highly unlikely as Athens and Corinth were rivals and would not have traded. After dilution corrections had been carried out, the Perachora sherds formed a single cluster which associated with Corinth. This highlights the necessity to check for dilution, as generalisations may be made.

Another analysis which highlights the need to perform dilution corrections is the comparison of this project with the Perlman database for Late Bronze Age pottery. Cluster analysis indicated a similarity between Corinthian pottery and Mycenaean ware, and between Tiryns Late Bronze Age pottery and Argive Geometric. These results were dismissed when the FACTOR program separated the styles. In this case, dilution was most probably caused by variations in clay composition through time.

10: Another aspect of chemical analysis was highlighted by the comparison with Early Bronze Age pottery analysed by Michael Attas.[ATT82] Initially, only ten elements were compared, and the results suggested similar sources for Bronze Age and Black Glaze pottery from Tiryns, Asine and Corinthia. The inclusion of the results of the short irradiations caused the two wares to separate. Thus highlighting the significant difference a more detailed composition can have on the results. This shows that techniques such as NAA, which are capable of measuring a large number of elements simultaneously, are the most useful in provenance studies.

11: Sherds from Athens, Corinth and the Euboean sites of Chalkis and Eretria have been analysed by different laboratories and different analytical techniques. These included results from the Brookhaven National Laboratory, which uses six geological samples as standards. A chart allowing the conversion of Brookhaven results to results obtained using the Perlman standard was published by Brookhaven.[(YEH86)] Using this, the compositions determined by Fillieres *et al*[(FIL83)] at Brookhaven could be compared with the compositions from this study. The concentrations were in excellent agreement, therefore verifying the results produced from the present study. As the Brookhaven and MUCD concentrations are similar, the conversion chart can be used to open up a large volume of data for comparison.

Further comparisons with studies by AAS[(HAT80, LEM91)] and OES,[(BOA73, PRA74)] though direct comparisons were not always possible, have clarified the characteristic of the Attic, Corinthian and Euboean fabrics identified by this project.

6.2 Archaeological Conclusions.

The analysis of 802 sherds from the Archaic to Hellenistic periods defined the compositions for fourteen distinct fabrics, (summarised in Appendix 3). These are discussed below.

6.2.1 Athens

In the sixth century BC Athens dominated the production and trade of pottery in the Mediterranean. It led the field with its Black-Figure and Red-Figure wares, which had high quality, lustrous black glaze, and deep red clay.

This project analysed 45 sherds from the Athenian Agora ranging from the Archaic to Classical periods. After the removal of outliers, a very distinct group was defined. This suggests a single clay source was used in the Agora between 300-700BC. This Attic group was distinguishable by high Cr, Ce and Cs concentrations.

Examples of Attic Black Glaze ware were identified at the majority of the sites examined, emphasising the popularity of Attic fine wares. These sites ranged from Chalkis, on Euboea, to Tanagra on the Attic/Boeotian border. The latter had imported much of its pottery from its neighbour Athens. In the Peloponnese, Attic ware was discovered at Argos, Mycenae, Tiryns, Asine, Halieis and the festival sites of Nemea and Olympia. Notable exceptions were the rival sites of Corinth and Sparta, and the isolationist Elis. Pottery sherds from Jordan and Israel have also been recognized as Attic, highlighting the extent of Athenian influence.

The importance of Attic pottery has led to several studies of Attic compositions using various analytical techniques such as OES,[PRA74,BOA73] AAS[HAT80,LEM91] and NAA.[FIL83,WOL86] The pottery analysed in these previous studies ranged from Archaic to Hellenistic wares. All of these studies have Attic groups with high Cr, Ce, Cs and Ni, where measured. This has been confirmed by the results produced in the present study, and shows the uniformity of the Athenian clay over 600 years.

6.2.2 Corinth.

Corinthian potters were the first to successfully adapt the oriental styles from the East to produce Protocorinthian ware. The Corinthians were a seafaring people and dominated the pottery industry at home and abroad during the seventh century BC. This dominance declined with the emergence of Attic fine wares.

Twenty-nine sherds from Corinth were analysed. Initially these formed two diffuse groups, however after performing dilution corrections the groups merged to form a single cluster. This implies the Corinthian clay is diluted by a mineral low in trace elements. Earlier mineralogical studies[FAR64] have described Corinthian pottery as a calcareous ware containing fine grained $CaCO_3$ which is inseparable from the clay. NAA detected a large concentration of calcium, indicating the presence of limestone. As this has low concentrations of trace elements, the presence of limestone lowers the average concentration of these elements in the potters' clay, i.e. acts as a diluent. Therefore the high limestone content of Corinthian pottery is the probable cause of the dilution effects.

Dilution effects initially distorted the results for twenty Protocorinthian sherds from Perachora, which is close to Corinth, and was expected to import pottery from there. Initially cluster analysis implied a mixture of Corinthian and Attic pottery. This is highly unlikely as Attic pottery during the seventh century was inferior to that from Corinth. Dilution corrections simplified the results, producing a single cluster associated with Corinthian ware. The Perachora samples also contained a large amount of calcium, reaffirming $CaCO_3$ as the cause of dilution effects.

Corinthian pottery was not as widespread as Attic ware. Samples were identified at the festival sites at Nemea and Olympia, and in the Argolid at Mycenae, Berbati, Argos, Tiryns and Asine. Corinthian ware was also identified at Lachish, Israel.

Corinthian Handmade ware from the Archaic period corresponded with the composition of Classical Corinthian pottery, showing a single clay source was in use at Corinth for over 500 years. This ware was also exported and some Handmade Corinthian sherds were identified at Tiryns and Argos.

As with Attic pottery, Corinthian ware has been analysed at different laboratories. The comparisons of the MUCD data and two earlier NAA studies[FAR77, FIL83] were not as encouraging as the Attic results. This suggests that Corinthian ware was less uniform, possibly caused by dilution effects. All the mean pottery groups contained high calcium contents.

6.2.3 Euboea

Chalkis and Eretria, the two major cities on the island of Euboea, lay just 20km apart on opposite sides of the Lelantine Plain.

Twenty Black Glaze sherds from Eretria and twenty-three from Chalkis were analysed along with thirty Late Geometric sherds from Chalkis. The analysis of the Chalkis samples produced two groups. One of these was a four membered group distinguishable by high Cr. By comparing this group with the Attic sherds, it was identified as Athenian.

Combining the two sites resulted in three groups; the four Attic sherds and two close groups containing a mixture of sherds from both sites. To determine the "closeness" of the latter two groups, the Euboean data was compared with the mean and standard deviations of the two groups. The groups were very similar, suggesting a single source.

A correlation between Sc and Fe was seen for both sites. This could have distorted the results giving one group. However, the range of concentrations was the same for both sites affirming the likelihood of a single Euboean source.

An investigation into the exportation of Euboean pottery by AAS also identified a single source.[POP83,LEM91] Analysis had included sherds from Chalkis, Eretria and Lefkandi, a small site on the Lelantine Plain. The inclusion of the latter sherds suggest the clay source was on the plain. As Chalkis and Eretria were near each other, but not very friendly, it is likely that both sites produced their own pottery. Hence the clay source identified in the present study and earlier analyses is a Lelantine Plain source. The extent of the compositional similarity can only be speculated without evidence of kiln sites.

The results of the AAS and NAA analyses could not be directly compared as different standards had been employed. However the elemental trends were very similar. Both groups had a high aluminium concentration.

Finally sherds from the Boeotian sites of Akraiphnion and Tanagra were identified as being from the Central Euboean source.

6.2.4 Boeotia.

Two Boeotian sites were included in this project. The majority of the 19 sherds from Tanagra were imported from neighbouring Athens, though an example of Central Euboean ware was also detected. The analysis of 16 sherds from Akraiphnion produced two groups and three outliers, including one possible local kantharos. Due to its high Al content one group was identified as Euboean. The second group has shown no similarities to any of the other sites analysed within the project. This suggests a local ware. As Akraiphnion was not a major citadel, it is likely that I have defined a Boeotian source which supplied Akraiphnion, and was different to the clay used for the outlying kantharos, if that is indeed a local ware.

6.2.5 Elis.

Elis was an isolationist state, remaining neutral during many of the wars to strike the Peloponnese. This detachment was reflected in the provenance of Elian pottery. It separated from all other sites, and Elian pottery was only found at the neighbouring site of Olympia. Elis controlled Olympia and its games, hence the presence of Elian pottery was expected.

A correlation between Rb and Cs was identified for the Elis Black Glaze ware, suggesting the clay contains a feldspar rich in Rb and Cs.

6.2.6 Sparta.

Sparta had been one of the dominant cities in the Peloponnese during antiquity. It had followed an isolationist policy, which was illustrated by the provenance of its pottery.

Twenty-five sherds were analysed, and after the identification and removal of outliers, two groups were defined. These groups showed no similarities with the other compositional groups identified in this project.

A selection of sherds from Argive sites did associate with the Spartan sherds. These associations were based on the concentrations for cerium and thorium, which were large in all cases. However, with the exception of HAL28, from Halieis, and MY34, from Mycenae, all the sherds were separated because of differences between the Cs and Rb concentrations. Three samples from Tiryns were very similar, suggesting a single source. This also had the characteristics of high Ce and Th concentrations, suggesting that these sherds were from a different source within Laconia, which has yet to be identified.

6.2.7 The Argolid.

6.2.7.1 Argive Black Glaze.

The initial analysis of twenty sherds from Argos gave a poor result of one group and a number of outliers. Unfortunately very few of these were assigned to other sites, (ARG20 to Athens, and ARG3,4 to Corinth). The group was distinguishable by a large Mn and small calcium content. This suggests a non-calcareous clay with minerals rich in manganese. The inclusion of the latter could be a cause of the dilution problems encountered during analysis. A correlation was also seen for this ware between Sc and Fe.

Black Glaze ware from the six Argolid sites of Mycenae, Berbati, Tiryns, Asine and Halieis associated with the Argos group, suggesting a single source for this style. The Argive group from each site showed the Sc/Fe correlation seen for Argos. The correlation coefficients were similar for all six Argolid sites, giving further evidence for a single source.

Argos was the major citadel in the Argolid in the Classical period, and has always been believed to be the source of Classical wares. The analysis of Black Glaze pottery from various sites within the Argolid suggests a single source of clay was used, which may be assumed to be Argos. However without kiln wasters, which would provide unequivocal evidence of a place of manufacture, no conclusions can be drawn.

6.2.7.2 Argive Geometric.

The analysis of twenty-nine sherds from Mycenae highlighted the differences between Black Glaze ware and the local ware known as Argive Geometric. The latter fabric was calcareous and low in manganese-rich minerals. This new compositional group was included in the remaining analyses. These identified Argive Geometric pottery at Argos, Berbati, Argive Heraeum, Tiryns, Asine and Halieis. No Argive Geometric pottery was discovered outside the Argolid confirming it as a local ware.

Argos was also thought to be the source of Geometric ware.[PRA93] The differences between the two Argive styles suggests two sources of clay, which may or may not have been situated at Argos. It would appear that during the Archaic period a calcareous source was used, which is known to give a dull glaze(FAR64). However with the rise of Black-Figure ware a new source, with a low calcium content, had to be found which would give a good quality black gloss. Consequently the Argive Black Glaze ware was made from a non-calcareous clay characterised by a high manganese concentration. Unfortunately without further evidence, such as kiln material, these conclusions can only be assumed.

6.2.7.3 Argive Unknown.

During the analysis of sherds from Tiryns and Asine a selection of sherds remained unassigned. Examining the compositions of these sherds highlighted similarities, with chromium and manganese concentrations lower than those found for any of the compositions identified during the project. However, when the Asine sherds were compared with those from Tiryns using MAHALA, no affiliations were seen. This suggests that two distinct but similar fabrics have been identified. The Asine group did contain a couple of sherds which were thought to be local. This suggests that this unknown ware originated from Asine. However, further work is required to identify the source or sources of this pottery.

6.2.7.4 Argive Handmade Wares.

To investigate the variation in clay composition through time, a selection of Archaic Handmade wares from the Argolid and Corinthia were analysed.

The composition of the Handmade ware from Corinthia was very similar to the composition of the Archaic Corinthian ware, suggesting a single source was used at Corinth.

The analysis of forty-four sherds from Argos produced a number of outliers, two of which were identified as Corinthian. After the outliers were removed a large group was observed. This group was different to the Argive Black Glaze and Argive Geometric groups suggesting yet another source of clay in the region. As with the other Argive styles the source of this pottery has been believed to be Argos.[PRA94]

A selection of handmade pottery from Tiryns was also analysed. Four groups were identified during analysis. One of the groups, OM3, consisting of Pie ware samples, was recognised as Argive ware. Corinth was established as the source of another group, OM1. Of the final two groups, OM2 contained an unusually low concentration of calcium. Consequently, it was defined as a non-calcareous ware from an undetermined source, most probably in the Argolid. One outlying sherd, AM22 from the Argos analysis was found to be a member of this group. Finally, OM5B showed a slight resemblance to the Argive Geometric group. This was dismissed after dilution corrections separated the two groups. OM5B is also thought to have an Argive origin, which has yet to be identified. As OM2 and OM5B were excavated at Tiryns and have remained isolated one could assume that one or both styles originated from there. Of course without further evidence this cannot be substantiated.

6.2.8 Database Comparisons.

The analysis of sherds from sites across the Argolid identified seven different clay compositions. These included an Argive Black Glaze group, an Argive Geometric group and an Argive Handmade ware group all thought to originate from Argos. This implies that the potters from Argos used a number of different clay beds between 800 and 300BC. Over the same period of time Corinthian potters extracted clay from a single source. To investigate the use of clay beds over a larger time period, the results of this project and Bronze Age analyses were compared.

The comparisons with Early Bronze Age sherds[ATT82] from Tiryns, Asine and Korakou were initially encouraging, showing similarities between the older and newer wares. However, when the concentrations of a further seven elements were made available, the early and later material separated. Some similarities were seen between sherds from Lake Vouliagmeni and Corinth. The former group contained a number of Archaic sherds thought to be Corinthian. Consequently, the inclusion of these sherds caused the two compositions to be in agreement.

Late Bronze Age sherds from Tiryns divided into two groups. One containing sherds from Mycenae, the other was thought to consist of local sherds. Comparing these sherds with their Classical counterparts revealed a similarity between Corinthian ware and the Mycenaean sherds, and between Argive Geometric and local sherds. Unfortunately these similarities were caused by dilution effects, since correcting for dilution caused the groups to separate. These results suggest that the dilution effects could have been caused by slight changes in the composition of the clay through time.

Appendices.

Appendix 1:

Elemental Concentrations.

Elemental Concentrations.

Introduction.

The following pages contain the elemental concentrations for all the sherds analysed in this project.

Twenty four elements were measured, however for some samples the concentrations for Co, Eu and Ta have been omitted. This was due to the omission of these in elements in previous studies.(BUR86,TOM88,FOY90) Due to problems in the low energy region of some spectra a number of Sm concentrations have also been omitted. The elements are given in the following order;

Na, Al, K, Ca, Sc, Ti,
V , Cr, Mn, Fe, Co, Rb,
Cs, La, Ce, Sm, Eu, Dy,
Yb, Lu, Hf, Ta, Th, U.

Manchester Museum Samples.

Black Glaze sherds from Athenian Agora.

AG01	0.5517	6.3960	2.8890	3.8650	23.7511	0.3616
	99.1560	613.9419	844.3931	6.1104	38.1683	155.1887
	14.0309	34.5868	71.6199	6.3842	1.4310	4.3890
	2.5766	0.3836	3.8884	1.3068	17.2062	2.4971
AG02	0.6600	8.8930	1.9370	4.4930	34.0567	0.5566
	119.2370	505.1465	709.3660	5.9258	48.2306	150.8426
	12.0361	48.8227	76.0900	9.3494	0.0000	4.4061
	4.0051	0.6504	3.3380	1.0147	12.2338	3.0539
AG03	0.6076	9.8070	3.2910	3.4160	20.9292	0.5067
	117.6650	569.0071	655.2451	6.4003	41.9260	174.1977
	13.0819	31.9655	80.8110	5.8695	0.0000	4.4195
	2.8120	0.4145	3.8610	0.9754	13.2667	2.1106
AG04	0.6067	9.1470	2.7190	5.2900	24.7347	0.3564
	136.6810	463.5557	879.6631	6.0041	39.3853	153.0018
	10.4056	34.8544	75.4093	6.5323	1.6124	5.6410
	2.3320	0.4831	8.4780	2.4920	30.0842	1.8010
AG05	0.5126	9.6210	2.8410	3.6420	23.6216	0.4888
	134.3210	509.1809	776.1550	6.2701	36.8470	158.1429
	10.3477	30.7533	69.8566	5.6782	1.5209	5.9210
	2.4894	0.3779	3.6440	1.2542	16.1583	1.8124
AG06	0.4955	10.1040	2.7880	2.4470	23.5381	0.5098
	133.6090	599.5950	653.1030	6.1806	39.0515	155.1499
	14.3421	32.2193	72.8032	5.8707	1.6291	5.0390
	1.9955	0.3733	4.6329	1.1253	12.4776	1.9780
AG07	0.5450	9.2990	3.4900	3.7680	26.2184	0.4935
	127.6490	523.7651	794.3340	5.7989	33.6960	152.0433
	12.3260	36.8148	65.5060	6.7260	0.0000	3.9811
	2.4078	0.4425	3.8690	0.8795	11.5842	2.6625
AG08	0.5253	11.6000	3.0290	3.1790	24.4951	0.5321
	154.3650	615.4658	817.0039	6.3932	40.5333	163.1201
	13.4479	35.0403	76.5936	6.3473	1.2941	5.4280
	3.0534	0.4047	3.1394	0.5866	8.2096	1.9220
AG09	0.5599	9.0470	2.7760	3.4720	22.4127	0.5095
	130.4250	531.8533	722.0601	5.4940	35.2387	143.3550
	12.2986	33.4126	68.6107	6.1669	1.4703	5.5230
	2.4630	0.4177	4.7658	1.6798	19.8026	1.8659
AG10	0.5423	9.0090	3.6100	5.3000	24.6352	0.5279
	141.7060	709.7781	695.8850	6.0684	49.4616	169.7820
	16.4174	33.4999	71.6729	6.2252	1.6376	5.7630
	2.4142	0.4067	7.2802	2.7619	27.7592	2.1287
AG11	0.4986	8.6330	3.0430	4.8950	23.8881	0.5652
	129.2640	666.6223	856.4771	5.7994	38.9487	144.8295
	15.3204	33.6932	70.6980	6.2040	1.3106	5.0670
	2.3862	0.3533	4.4748	1.5685	17.9603	1.8143
AG12	0.4259	7.9920	2.4460	8.4640	21.4467	0.4335
	111.5230	553.7632	846.0039	5.7473	35.1301	130.3093
	11.6629	28.6721	62.9119	5.4757	1.2460	4.7180
	2.6216	0.3734	3.2590	1.1645	12.3581	2.0013
AG13	0.4755	8.7820	3.0540	4.7080	23.8718	0.5119
	116.8530	544.6179	957.9390	5.9811	37.7341	149.4311
	12.8192	33.5199	72.6306	6.2600	1.2282	5.1430
	2.5445	0.4115	3.6020	1.1982	13.4329	2.0817
AG14	0.5478	8.6460	3.0000	6.3050	23.7583	0.4990
	124.0660	529.3381	842.4451	5.8969	33.9630	138.9008
	11.3617	32.7022	65.3522	6.1541	1.2181	6.0060
	2.4252	0.4657	3.3454	1.0847	13.3743	2.2299

AG15	0.4292	8.2990	2.4390	6.6600	22.8696	0.5266
	149.8590	619.9485	882.5020	6.5446	39.4923	157.6669
	13.6218	31.4846	75.9768	6.0094	1.4293	5.5470
	2.5260	0.4237	4.3974	1.4535	16.0648	2.9610
AG16	0.5287	8.6840	2.6970	5.4050	22.4184	0.3844
	122.3600	517.5051	1032.8169	5.2964	31.4805	117.3924
	10.1814	33.0232	59.1607	5.9941	1.0912	4.7940
	2.8314	0.3751	3.7643	1.3117	15.5196	2.4572
AG17	0.5695	8.3640	2.9300	4.0420	21.7862	0.4608
	110.4990	476.8811	1245.7839	5.4871	35.4943	136.3671
	10.6461	33.6324	66.0892	6.2417	1.2754	6.3780
	2.5923	0.4497	4.2070	1.3178	13.7210	3.0232
AG18	0.5617	8.2220	2.3680	4.2810	24.1090	0.3956
	119.5340	594.4951	773.4951	6.1753	33.6353	152.5307
	12.3155	33.8827	71.7364	6.3414	1.2060	4.4620
	2.8152	0.4413	8.0933	3.0178	27.8122	2.3240
AG19	0.6790	8.4910	3.0080	3.6940	21.4244	0.5411
	94.9400	505.7527	717.0339	5.7222	33.6055	140.5685
	11.4840	33.9201	73.0963	6.1276	1.3807	5.1230
	2.5287	0.4054	4.0158	1.3543	13.6913	1.9569
AG20	0.4744	10.4350	1.1060	5.1920	21.7609	0.5753
	148.3950	341.8816	1100.6641	6.3022	30.4187	134.2372
	12.4776	46.7140	102.5732	7.4820	1.5407	6.1920
	3.5702	0.4968	2.7677	0.9368	10.1728	3.0438
AG21	0.4763	8.1370	2.7730	4.7890	22.4457	0.4931
	132.8850	516.0403	992.8340	5.7508	35.8794	134.5336
	14.6825	32.6614	70.3711	6.2702	1.3850	4.5910
	2.2613	0.4641	4.7738	1.6940	17.6622	4.0992
AG22	0.5750	7.4230	2.3270	10.1660	19.8854	0.3693
	95.9480	520.8835	910.5959	5.1063	30.6239	124.7024
	11.0085	30.4440	63.9781	5.6265	1.2783	4.8460
	2.3983	0.3613	4.0573	1.2331	16.2039	2.0078
AG23	0.5842	8.6280	2.4950	3.9100	23.9208	0.4930
	112.7160	660.9727	867.4519	6.4162	40.4017	159.0670
	14.0931	32.4414	70.2567	6.0036	1.2176	4.5230
	2.5266	0.4463	3.9545	1.2484	14.3209	2.1068
AG24	0.5553	9.0760	3.4510	4.1720	22.9236	0.5076
	120.6270	524.3997	669.0010	6.0378	36.5921	152.9211
	13.5960	33.8799	72.6211	6.2870	1.3702	4.4030
	2.6522	0.4118	4.2227	1.3750	15.4679	2.4617
AG25	0.5617	9.2400	3.1090	3.3860	21.0467	0.5282
	113.7700	580.6467	803.0911	5.7173	38.7956	132.1736
	12.3715	27.8083	62.6036	5.2615	1.1745	5.9670
	2.1271	0.3841	3.0966	0.8284	9.9257	2.1696
AG26	0.5317	8.8520	2.7660	3.4020	21.0822	0.5228
	115.5780	469.0349	686.6741	5.4054	32.5786	141.6219
	11.3876	30.3087	64.0575	5.5979	1.3507	5.3210
	2.2123	0.3878	4.1782	1.0038	12.0170	2.1539
AG27	0.4922	9.0590	3.1270	4.8680	19.8102	0.4940
	121.3810	523.8979	1010.4351	5.7761	35.5591	145.5066
	15.2408	28.3609	70.6352	5.3849	0.0000	4.2120
	1.9921	0.3417	4.1270	0.8818	11.2930	2.0439
AG28	0.6061	10.9820	2.4490	6.5510	21.8207	0.4994
	143.9140	603.2124	741.5530	5.4034	32.8545	146.8418
	12.7506	32.8871	68.6106	5.8009	1.3813	4.8300
	2.0722	0.4048	6.4994	1.2846	16.2110	2.1910
AG29	0.6190	7.5050	3.4530	6.0870	23.8066	0.6110
	174.5640	625.2344	770.8040	6.1515	37.1770	169.6868
	14.7491	33.3329	70.3054	6.2154	1.5956	5.3580
	2.4139	0.4075	4.0165	0.9412	12.1193	2.2136

AG30	1.5670	8.4900	3.1030	6.5610	29.3642	0.5092
	128.5780	677.5937	1107.9670	7.4834	56.9465	187.5199
	13.7651	40.8489	86.9934	7.0176	0.0000	5.2955
	2.9116	0.5305	5.3930	0.9342	14.9916	3.9828
AG31	0.5783	8.6630	2.7450	5.9270	25.3785	0.4517
	117.1530	621.2185	773.0339	6.1191	38.9782	167.2320
	13.9262	35.9310	74.5115	6.7738	1.4385	5.2310
	2.9772	0.4560	4.1168	0.8214	12.3941	2.1684
AG32	0.6452	9.1450	3.1650	4.2710	25.1641	0.5118
	118.3510	578.6094	828.2429	6.1980	40.9764	170.0137
	13.8350	36.5639	73.4138	6.9261	1.3818	4.6670
	2.8699	0.4385	4.5016	0.8450	12.4843	1.8861
AG33	0.6495	9.2470	3.7850	5.0550	29.8458	0.4970
	124.0520	675.4583	713.1860	7.0979	41.7604	179.2717
	14.9379	45.1612	81.8177	7.4191	0.0000	4.6099
	3.5076	0.5559	3.8490	0.9242	14.0219	3.4811
AG34	0.5153	9.1480	3.0780	3.8040	27.0759	0.4595
	130.6690	541.4380	632.9641	6.2392	38.0472	181.1094
	13.9969	39.2118	75.8342	7.2633	1.3632	5.4480
	2.9370	0.4915	3.8777	0.8447	12.8410	2.2521
AG35	0.5079	9.0850	2.4340	3.7160	25.7923	0.5789
	117.1300	551.2090	720.6069	6.0940	36.5841	165.9757
	13.7684	37.5462	74.9894	6.9157	1.2389	4.5120
	2.8032	0.4459	3.6291	0.7849	12.3597	2.8842
AG36	0.6139	9.3390	3.0170	3.4480	26.6228	0.5249
	121.6510	623.2197	722.7109	5.9208	38.4827	174.4706
	13.3967	33.0525	73.6394	6.0695	1.5198	5.3080
	3.2716	0.4763	4.6169	1.0015	12.7538	2.4532
AG37	0.6579	8.3760	2.6580	5.2640	24.8146	0.4384
	128.3360	607.1265	1042.9541	6.1613	42.3567	143.7340
	13.3615	38.0745	77.0996	7.1209	1.7930	6.9900
	2.7552	0.4933	3.6630	0.8609	11.6859	3.1448
AG38	0.5684	9.4210	3.4840	3.1540	26.0784	0.4851
	120.5430	555.1177	816.3870	6.2064	43.8932	182.5303
	14.2617	39.5645	76.2744	7.3802	1.6466	5.0360
	3.4815	0.4812	4.0342	0.9447	13.2013	2.9172
AG39	0.5804	9.1070	2.9990	3.6490	24.5439	0.5250
	107.6700	573.2073	995.6980	6.1280	40.0040	154.1536
	13.7737	34.4819	73.6953	6.5029	1.4069	3.6090
	2.6918	0.4643	4.6408	1.0265	12.5858	2.2766
AG40	0.6694	9.2760	2.4000	3.4380	26.1567	0.5239
	121.9170	516.8748	741.8159	6.1528	41.4741	158.9450
	12.2733	36.7942	74.3697	6.9122	1.4951	4.1290
	2.9915	0.4849	4.9174	1.0078	12.7664	1.8675
AG41	16.7134	10.5260	3.4570	3.8070	859.3489	0.4700
	172.9260	642.4065	735.3440	7.3019	44.1705	216.3117
	15.9832	1214.5957	85.9827	227.1632	1.4756	5.4820
	95.1937	15.1809	4.7197	1.1537	14.6278	78.6720
AG42	0.6787	11.8080	2.7880	2.9980	25.1329	0.5248
	157.6610	508.2317	719.6970	5.8693	39.9992	173.6331
	11.7565	37.3618	79.2015	7.0586	1.3086	4.5080
	3.1923	0.4661	4.6117	0.8603	12.4222	1.9855
AG43	0.4803	9.3470	2.8960	4.3360	23.4902	0.6052
	111.9630	582.9419	930.1641	6.3924	38.9882	158.9423
	17.3089	33.0758	76.7870	5.8518	1.2075	5.6200
	2.3786	0.4422	4.2179	1.0426	12.7965	2.6061
AG44	0.5913	8.9490	3.1360	3.9030	24.9589	0.5287
	113.0170	554.3606	729.9260	6.0881	40.9886	164.2581
	13.3568	31.8330	67.4794	5.8240	1.3048	5.1790
	2.8175	0.4268	4.0181	0.9580	12.0479	1.9167

AG45	0.5471	8.8300	3.1120	6.6760	25.5663	0.4274
	110.3700	574.2227	946.0420	5.9784	35.2715	161.0066
	13.6839	36.0344	70.5675	6.7206	1.0592	5.5920
	2.7089	0.4069	3.2578	0.8462	11.7489	2.2471

Black Glaze sherds from Argos.

ARG01	0.5997	8.5900	2.5900	4.5380	18.8084	0.4920
	117.9220	228.2632	1121.2629	4.7016	34.1731	114.5650
	5.2862	38.4126	69.6652	6.1714	0.0000	5.4880
	2.5086	0.4590	5.0740	0.8881	11.9716	2.8410
ARG02	0.7425	8.1410	2.8430	4.1410	19.5564	0.4779
	102.6430	263.1467	1228.9009	5.1727	0.0000	125.1516
	6.9049	35.4384	73.3534	0.0000	0.0000	5.8320
	0.7529	0.4235	5.9144	0.0000	12.7308	3.4720
ARG03	0.6240	8.4200	2.0740	6.3790	19.1119	0.5002
	108.8970	252.2403	1022.4319	4.9920	38.5089	122.1602
	8.0639	32.9174	65.7018	5.9242	0.0000	4.1950
	0.8631	0.4256	4.6065	1.1607	11.4113	2.5440
ARG04	0.6699	8.8620	2.4790	7.4180	19.2415	0.5168
	132.6470	270.0916	957.8979	5.2083	41.2455	142.1984
	8.3944	35.6699	72.7976	5.9256	0.0000	4.2370
	0.7515	0.4748	4.9636	2.2505	11.4544	3.4720
ARG05	0.6274	9.4630	2.8660	4.1670	21.8129	0.4432
	124.9960	284.1396	1550.2971	5.7506	0.0000	147.2095
	7.5971	43.6655	87.4664	0.0000	0.0000	5.8560
	0.9224	0.5292	5.6985	0.0000	14.1276	3.2060
ARG06	0.6867	8.9090	1.9470	3.9720	20.6041	0.4671
	103.1180	266.2356	1395.0991	5.5837	0.0000	138.8226
	6.9761	44.3927	83.2519	0.0000	0.0000	4.7690
	1.0456	0.5096	6.2850	0.0000	13.9656	3.6280
ARG07	0.4587	7.8840	2.0900	9.9360	35.2398	0.4466
	107.6090	393.1418	1024.7100	8.9808	0.0000	244.7430
	15.2822	55.8120	101.8149	0.0000	0.0000	5.0360
	1.0483	0.6725	4.7002	0.0000	18.5868	2.5950
ARG08	0.9518	8.6830	2.6500	8.0030	19.6866	0.5880
	110.9840	217.2538	1352.2300	5.1115	26.5916	111.4658
	5.3734	31.4047	67.5507	5.9233	0.0000	5.7880
	2.3108	0.4225	4.5180	0.9006	11.7029	3.7790
ARG09	0.6709	8.8060	2.8700	4.3660	18.5800	0.4883
	105.9610	217.0419	1064.7019	4.6671	36.1201	129.3969
	6.5008	36.0875	70.5376	5.9452	0.0000	5.8510
	2.6199	0.4545	5.3825	0.7742	11.2901	3.2960
ARG10	1.0005	10.6380	2.8870	5.0620	20.5027	0.5471
	112.4280	153.4048	689.7090	5.2423	0.0000	148.3455
	67.7849	44.1691	90.5867	0.0000	0.0000	6.6240
	0.8893	0.5265	5.7275	0.0000	17.4243	3.8560
ARG11	0.7343	9.8660	3.1920	3.3050	35.6833	0.5025
	151.6090	422.6423	1554.7539	9.0535	0.0000	157.2285
	14.1947	54.1545	92.4913	0.0000	0.0000	5.7770
	1.0772	0.6150	5.1265	0.0000	17.7786	3.1180
ARG12	0.6561	10.0970	2.9020	3.5920	24.5258	0.4888
	161.8410	289.9531	1578.5271	6.6770	40.2394	165.6150
	8.2291	36.0034	70.2675	6.0640	0.0000	4.7980
	0.9242	0.4621	4.6532	1.1486	13.5892	3.7480
ARG13	0.7874	10.3490	2.9740	3.6810	19.1077	0.5010
	165.8770	250.0064	1617.8979	4.6597	31.7761	160.8811
	8.1517	38.9313	69.9383	6.0169	0.0000	4.9180
	2.4432	0.4540	5.2700	1.2663	11.9386	3.8410

ARG14	0.6493	9.0180	2.2160	4.1430	20.8582	0.4812
	132.5600	274.1284	1205.2600	5.6761	33.9555	140.9973
	6.0364	43.7253	82.4497	7.4893	0.0000	5.9190
	3.0225	0.5001	5.3200	1.1629	13.7478	2.9040
ARG15	0.7784	8.2480	2.7650	3.9570	18.6235	0.4997
	102.7690	281.7415	1155.7871	5.0700	31.6059	140.7204
	5.8181	36.3000	68.1946	6.1911	0.0000	6.7250
	2.8053	0.4102	5.5130	1.1590	12.2302	3.4930
ARG16	0.7425	9.0790	3.0280	4.6990	20.2352	0.5586
	121.5850	249.4503	1313.8210	5.2242	36.3056	112.8546
	6.8904	42.9313	81.9179	7.0539	0.0000	6.3090
	3.1481	0.4739	5.6340	1.1602	13.6520	3.3210
ARG17	0.6325	9.0640	2.6970	5.8200	19.8789	0.4122
	129.8040	208.3172	1260.1650	5.1845	29.3410	118.9124
	7.4972	40.4969	79.1330	6.7089	0.0000	6.3280
	0.7645	0.4122	5.5646	1.3289	12.9510	3.5000
ARG18	0.3906	9.1190	1.8240	6.1700	30.3442	0.5837
	132.1970	402.2930	1149.8899	7.9644	0.0000	176.6249
	10.1827	63.4513	121.9598	0.0000	0.0000	6.3980
	1.4587	0.7435	8.6201	0.0000	19.9659	2.6890
ARG19	0.7889	9.0680	2.0070	3.5630	20.3558	0.4373
	145.9960	241.2847	1086.6321	5.1050	38.8983	152.6224
	7.5830	40.8189	80.6445	6.6573	0.0000	6.2380
	3.0329	0.4474	5.3410	1.1490	13.5556	3.3730
ARG20	0.4928	8.6800	2.3810	6.3920	21.2521	0.4980
	131.7460	486.0671	1074.9780	5.3989	33.5525	135.3126
	11.0432	32.8500	72.0292	6.1434	0.0000	4.7240
	2.4495	0.4066	3.7280	0.7900	10.8197	2.9880

Black Glaze sherds from Akraipnion.

AK20	0.3989	7.4470	1.7680	7.6470	16.7209	0.4159
	87.9720	478.5576	802.2000	4.4846	29.6483	94.8834
	6.8907	28.6736	58.1072	4.7656	1.0577	4.2330
	1.7784	0.3912	5.2643	0.8139	10.0527	2.0660
AK21	0.7347	10.8180	2.5170	3.2340	23.6555	0.4826
	111.6960	187.1795	1006.4729	6.3115	26.5431	154.4964
	9.2519	38.9443	85.9567	7.2595	1.7853	4.7780
	1.6010	0.3733	4.2107	1.4970	16.4742	2.6980
AK23	1.0176	10.3510	3.1530	2.7520	24.4911	0.4317
	124.7140	181.5162	1115.9580	6.4051	26.8785	161.7457
	9.3702	37.5276	89.7855	6.6532	1.2759	4.9810
	2.7536	0.5077	4.2220	1.6070	14.8823	2.2890
AK24	0.8612	10.5520	3.2130	3.4550	25.0222	0.4570
	115.4760	162.2536	1001.5769	6.0203	24.9442	169.7800
	11.7413	41.8888	78.4616	6.8401	1.4641	6.0390
	4.1447	0.4896	3.8767	1.0698	14.6146	2.9500
AK25	0.9412	10.6320	3.5820	3.2610	24.0287	0.5121
	123.1580	167.4595	1047.4839	5.9374	24.9109	178.5180
	10.1831	36.5474	76.8244	6.0445	1.2862	5.1510
	2.7225	0.4419	3.5926	0.7706	14.6416	2.8440
AK26	0.2935	8.9650	1.3630	5.3840	26.4832	0.5416
	109.4030	463.7307	886.0190	7.1716	43.4588	85.8504
	4.2776	33.5404	70.8822	5.2280	1.0695	4.4810
	3.0409	0.4528	4.3546	1.0481	11.4216	2.3420
AK27	0.3347	8.5110	1.3020	6.0190	24.8389	0.5098
	122.1660	441.8113	799.9580	6.8778	42.8873	98.3659
	4.5703	32.1181	70.4463	5.5885	1.0066	4.3990
	2.5051	0.3522	3.5859	0.9180	11.3179	2.2210

AK28	0.3973	8.9400	1.2380	5.6190	26.1255	0.4516
	121.7030	468.7556	868.0181	7.0117	43.9609	120.2845
	5.3803	32.1387	69.6305	5.7330	1.2897	3.5060
	2.2267	0.5526	3.5399	0.7800	12.0618	2.3550
AK29	0.9361	8.8500	2.0160	2.4510	18.0406	0.5472
	101.5290	305.4888	809.7419	4.5809	19.3606	93.4843
	5.0693	36.2152	81.4592	6.5192	1.4775	5.5070
	3.9098	0.4307	6.0049	0.9999	13.2521	3.4010
AK30	0.3232	8.1800	1.1270	5.8280	22.0832	0.4893
	142.2470	391.8257	842.9939	5.8662	38.2055	80.0310
	3.9167	31.1138	58.7581	4.9593	1.3588	4.2080
	2.8644	0.2793	3.0861	0.7762	10.0681	1.6950
AK31	0.3345	8.5560	1.0490	6.4280	25.1126	0.4930
	120.1510	431.4373	1027.2439	6.8344	41.7559	72.1209
	2.6307	31.6273	72.3651	5.1836	1.1302	4.4550
	3.0585	0.2279	3.5963	1.1228	11.0044	3.2130
AK32	0.2291	8.6610	1.7240	5.1290	25.7813	0.4516
	133.9990	470.2686	901.5759	6.9627	44.2265	56.6795
	4.0671	32.0077	63.0012	5.6975	1.2481	4.6090
	2.5021	0.4518	3.6914	1.1923	11.8206	1.8690
AK33	0.2639	8.9530	2.0700	4.9620	24.4361	0.5872
	138.4790	421.3269	907.5911	6.6070	42.9751	61.8069
	2.8057	30.9283	58.2019	5.8544	1.5383	4.9630
	1.1245	0.5477	3.3029	0.9117	11.1349	3.0200
AK34	0.3125	8.7070	1.3610	5.6800	23.9875	0.4595
	147.9390	408.2935	1046.8020	6.5230	42.5035	76.4387
	4.4066	30.5851	64.0337	4.9999	1.2447	3.4590
	2.6241	0.3417	3.5374	1.1183	10.6024	3.2680
AK35	0.2414	8.7060	1.1020	4.9780	24.2721	0.5265
	152.7770	419.5803	919.4961	6.3854	41.8814	45.2028
	2.4181	31.8771	64.9755	5.0760	1.2666	3.8180
	2.4796	0.3048	3.4110	1.2845	10.9002	2.2610
AK36	0.4809	7.5380	1.4160	6.1250	21.3085	0.4199
	101.4670	433.8437	764.7209	5.7527	28.0304	99.3717
	5.1099	25.1252	50.9352	4.6248	0.9605	4.5830
	1.7274	0.3877	4.8912	1.2150	10.9426	2.8210

Black Glaze sherds from Corinth.

COR17	0.6033	7.6390	2.3470	13.1670	20.3058	0.4136
	128.8290	231.3980	910.7500	4.9620	23.2164	113.1438
	7.0372	29.4359	51.2200	5.2554	1.1580	4.3760
	2.0136	0.3673	2.7166	0.7058	9.7465	3.0100
COR18	0.6642	7.5670	2.7460	13.3190	22.6063	0.3365
	106.9160	261.6267	979.6660	5.8330	29.1256	125.5681
	10.4196	34.3288	63.2187	5.6603	0.0000	3.7680
	0.7599	0.3920	3.2256	0.9527	11.8609	3.1840
COR19	0.5029	8.4740	2.2950	12.1280	22.1246	0.4060
	143.9060	244.8326	970.3169	5.5101	28.7612	141.6436
	9.1573	31.8473	58.8600	5.3215	11.1560	3.4420
	2.5339	0.3847	3.0948	0.7331	10.9434	2.4300
COR20	0.4590	7.8950	1.6250	13.3080	19.7168	0.3894
	146.4080	213.7607	955.9961	4.9547	26.8165	131.7145
	9.3605	29.8823	50.8656	4.8987	0.0000	4.4610
	0.7394	0.3418	2.2435	0.6431	10.2877	4.5590
COR21	0.4775	7.8620	2.5480	13.6720	20.3892	0.3917
	137.0040	218.7501	961.8660	4.9378	26.8781	123.0574
	9.0203	30.9277	53.6800	5.1565	90.9640	5.0440
	2.4197	0.3789	3.1694	0.7238	10.0351	2.5300

COR22	0.8483	8.0080	1.4520	12.6480	21.6317	0.4137
	129.7540	236.7799	885.7200	5.2622	15.9971	92.7368
	7.0580	40.2203	56.2839	6.6888	0.0000	2.2946
	3.0056	0.4621	2.8520	0.6820	10.0426	2.2340
COR23	0.7915	8.4720	1.6680	11.8420	22.4855	0.4792
	156.0650	241.4720	1008.9451	5.4501	28.2501	119.3934
	8.8316	32.7735	56.5900	5.4666	1.1400	4.1410
	2.6308	0.4212	2.9320	0.8672	10.8437	2.5300
COR24	0.6710	8.7270	2.9180	11.5490	15.4815	0.4237
	148.1070	236.6219	1042.6440	5.4851	19.6748	151.6506
	7.6272	23.7286	62.3534	4.1989	0.0000	2.4396
	1.8816	0.3199	2.9110	0.7731	11.4285	1.2417
COR34	1.0283	7.4830	2.4480	10.8970	21.3672	0.3599
	116.6830	236.2996	872.1951	5.0954	28.3772	134.2002
	6.4858	47.6860	53.9614	7.8957	0.0000	3.5940
	3.1406	0.5169	2.5520	0.7327	10.0991	2.7876

Black Glaze sherds from Chalkis.

C01	0.9803	10.8270	3.9710	3.2790	20.6429	0.4781
	122.9690	180.7900	1003.4441	5.2000	24.3879	127.3532
	8.8765	37.7521	80.0886	6.8696	1.3565	6.3720
	2.9421	0.5291	4.3430	1.6440	14.6481	2.0720
C02	0.9671	11.1200	3.5600	3.5510	22.2232	0.3965
	126.2380	170.7447	969.2529	5.4402	22.4557	161.8562
	10.0997	36.6476	74.8297	6.5176	1.5799	5.6930
	2.5414	0.4255	4.1636	0.7386	14.6100	2.5365
C03	1.4678	9.6730	3.8000	3.1920	19.2051	0.4225
	117.2090	160.8766	828.2810	4.5874	18.8995	121.5478
	7.9851	35.3410	79.6852	6.3602	1.3285	5.1480
	1.8043	0.4063	4.0124	1.4750	12.3329	1.3784
C04	0.6556	8.9810	2.9100	4.1160	23.4848	0.4469
	138.6980	435.4641	774.6101	5.6666	34.9690	129.6740
	10.0122	33.8498	70.9734	6.4893	1.2050	5.4920
	2.7948	0.3954	3.5387	0.9820	11.4773	1.7537
C05	0.9383	10.2530	4.3230	3.6500	19.9280	0.4513
	122.6980	156.1495	929.2849	4.9524	21.0755	131.2139
	7.9866	32.0205	66.5628	5.6855	1.0985	4.5860
	1.8372	0.3341	3.3421	1.3898	12.2178	1.2917
C6A	1.0672	10.0810	5.6330	5.9260	21.7788	0.4193
	117.6920	185.3278	761.6021	5.2718	20.5241	139.4507
	10.2117	41.6444	84.2458	7.2242	2.2861	6.3930
	3.1779	0.4098	4.1797	1.6299	14.8929	2.0067
C6B	0.9417	9.7620	3.2120	7.5080	18.6084	0.4958
	99.5880	160.4726	781.1069	4.4294	18.2768	118.2064
	9.7691	37.3424	71.0116	6.3132	1.4331	5.8860
	2.7340	0.4655	3.5060	0.7587	12.5526	1.7330
C41	0.4715	8.1910	2.5900	5.6970	23.2725	0.4966
	136.6570	421.4968	662.8350	6.1189	39.5466	124.7119
	6.7922	29.5970	60.1120	5.3225	1.1712	3.8850
	2.8293	0.3952	2.7385	1.0698	10.2469	1.1814
C42	0.8613	10.6320	4.1890	2.6810	24.4289	0.4131
	122.5650	198.9674	976.4280	5.7516	23.6704	154.8519
	10.2692	38.5517	76.2145	6.3124	1.4567	4.9480
	3.2450	0.4202	3.3594	1.5560	14.8217	1.8533
C43	0.8569	10.9920	3.8280	4.2170	22.3650	0.5093
	122.6130	168.7661	980.1499	5.5278	22.4679	148.5389
	10.1828	38.0058	78.3158	6.6881	1.3901	6.1740
	3.4007	0.4379	3.2290	1.0955	14.1778	2.4424

C44	0.7999	11.0560	4.2750	4.8230	24.2543	0.4293
	130.1910	199.1475	966.2629	5.9608	24.8685	157.3152
	12.0347	38.9902	76.7769	6.7464	1.3875	4.5740
	2.8898	0.4636	3.2238	1.2874	14.9968	2.6220
C45	0.6635	9.6017	3.3964	3.8455	27.5269	0.5874
	126.0969	604.0513	683.5825	6.8706	39.2030	152.1262
	10.6369	33.2200	68.3622	6.1932	1.1178	4.6632
	3.2585	0.4040	1.9747	1.0863	13.1241	3.5426
C46	0.8906	10.9550	4.6250	4.9740	25.0851	0.5001
	122.3420	201.4090	849.9290	6.1484	25.9430	146.9070
	10.3005	35.6638	74.0144	5.9560	1.5296	5.0270
	2.2837	0.4496	2.9774	1.1796	14.7279	2.3433
C47	0.4814	9.5435	3.0976	5.4100	26.9417	0.5637
	132.7431	634.7336	1076.3140	6.5459	42.3827	168.3008
	18.0504	39.1479	84.2755	6.8902	1.5223	5.0187
	4.0171	0.4092	2.1801	1.2275	13.4478	5.0105
C48	0.9638	11.3110	3.8600	3.1570	25.0390	0.4636
	130.8710	193.4184	931.3401	6.0436	23.9533	145.4113
	11.1121	40.8324	78.4263	6.9613	1.5362	5.0950
	2.9579	0.4786	3.1541	1.4624	16.2836	2.8397
C49	0.9211	12.3635	4.0318	3.1728	26.3833	0.5450
	154.9582	197.5608	995.9619	6.3491	26.6264	161.1529
	9.6584	39.6291	84.6284	6.7046	1.4958	4.6020
	2.2658	0.4695	2.1490	1.2169	15.7669	5.1673
C50	1.0674	10.7470	2.7510	2.6570	21.8457	0.5358
	129.2890	175.1469	913.0750	5.2887	22.3279	140.3821
	8.3476	38.8600	71.1453	6.2292	1.5305	5.6900
	2.1597	0.4937	2.8563	1.0433	14.1820	2.4883
C51	1.0156	11.6215	3.5389	2.9025	24.8682	0.5506
	121.6533	191.1880	1037.7090	6.0845	23.5832	180.7763
	10.5234	39.2660	87.5487	6.9398	1.3283	5.4965
	3.3270	0.4280	2.1794	1.3019	15.9393	4.9808
C52	0.9528	11.2960	3.3930	2.1460	26.1851	0.4932
	135.4870	190.9391	900.9180	6.1925	23.4201	186.6038
	10.6225	44.4629	91.7575	7.4502	1.5987	5.5740
	2.6488	0.4363	3.2181	1.9017	17.2377	1.9989
C53	0.8956	10.5807	3.5749	4.0409	26.8081	0.4679
	122.2453	207.3307	972.6611	6.5663	26.6294	181.0278
	11.8932	37.7637	83.4225	6.4061	1.6912	5.3199
	2.9890	0.4312	4.6683	1.4356	16.5734	3.8959
C54	1.0447	11.3010	4.5250	4.1440	22.5018	0.4651
	121.0700	175.6654	1039.5210	5.6400	24.6809	147.5825
	8.7170	34.7668	72.0367	5.8199	1.2876	5.1110
	2.5002	0.3550	2.5014	1.0814	13.6779	3.2698
C55	0.7559	11.5770	3.9700	3.9680	27.0849	0.3514
	133.3970	208.4424	996.6919	6.7100	27.6856	183.3977
	12.7672	38.3103	76.9187	6.4508	1.3042	5.1290
	3.7596	0.4110	1.1313	1.6613	16.9607	1.6527
C56	0.6545	8.5510	2.7180	5.0980	22.5733	0.4025
	124.2080	404.0117	851.8779	6.0882	37.3578	115.8492
	6.2124	30.8511	63.6049	5.1408	0.9383	3.6030
	3.3866	0.3758	0.8411	1.2857	11.7530	2.5262

Late Geometric sherds from Chalkis

CH01	1.0616	8.0754	2.6799	6.3367	16.8243	0.4035
	88.5407	135.8768	786.8713	3.9972	17.6488	131.3277
	6.8126	34.1440	70.2000	5.9939	1.5188	5.2133
	2.3188	0.2356	4.3727	0.0000	11.2799	3.3369
CH02	0.8526	10.5293	3.0616	2.8532	25.9455	0.5322
	123.5019	177.8408	968.7803	6.2893	25.4073	151.3120

	11.9977	39.7253	82.0547	6.4914	1.4803	4.9414
	2.2720	0.3236	4.5362	0.0000	16.8088	3.8294
CH03	0.8589	11.7815	3.7313	3.3052	27.7211	0.5948
	140.8302	239.5969	1078.9241	6.8226	28.1716	189.4956
	12.3072	42.4763	83.6294	7.0499	1.9936	5.8563
	3.8248	0.4290	4.8655	0.0000	16.4976	3.8277
CH04	0.5788	8.1700	2.4453	10.9148	16.5750	0.3421
	83.2800	112.3104	710.4595	4.0288	16.7483	114.9175
	6.9494	27.0905	53.7124	4.6694	1.1106	3.8157
	1.6187	0.2564	3.2131	0.0000	10.3499	2.9603
CH05	1.2378	9.9516	3.2535	3.0207	21.7821	0.5043
	119.0950	160.8077	862.2627	5.3016	22.3305	127.0002
	9.8733	39.0069	74.0730	6.5110	1.4016	5.7972
	2.5172	0.3187	4.1332	0.0000	14.5952	3.4106
CH06	0.9089	10.7506	3.2260	3.2167	23.6600	0.4985
	120.5009	170.4335	902.9724	5.6882	22.9285	159.0672
	9.3362	38.2118	74.0982	6.3775	1.4403	5.3620
	2.6314	0.4690	3.8824	0.0000	14.5752	3.5083
CH07	1.1045	9.7993	3.6844	2.9860	26.0691	0.4809
	116.8298	211.6045	929.8171	6.3114	26.3993	207.9103
	11.8294	44.5500	89.2686	7.4661	1.7980	4.9311
	4.2313	0.4582	4.6675	0.0000	16.5536	3.3173
CH08	0.9551	10.7326	3.0179	2.6760	23.0058	0.5013
	122.7185	174.3136	974.0005	5.6599	22.4685	162.8616
	8.9629	39.4837	80.7811	6.5878	1.5412	6.1225
	3.4251	0.3588	4.7353	0.0000	14.0839	3.2876
CH11	0.9246	10.5478	3.0976	2.8291	23.3856	0.5293
	107.9445	181.1713	936.2698	5.7116	22.9617	163.9886
	9.7344	41.0231	86.0550	7.0868	1.5066	5.5745
	2.8495	0.4833	4.8277	0.0000	15.2627	3.4372
CH12	0.8425	11.1770	2.9342	2.8868	24.0397	0.4884
	128.8446	177.6084	1021.0410	5.9644	23.9540	167.4451
	10.1994	40.1735	81.3260	6.8205	1.4896	5.3577
	2.3769	0.3267	4.5591	0.0000	15.6391	4.0646
CH13	1.6088	9.4714	2.3751	4.1676	22.6318	0.4760
	98.6937	190.0846	1000.7190	5.7598	23.6461	73.7647
	9.0498	33.9008	65.8722	5.4914	1.3320	4.3649
	3.9857	0.4364	3.4799	0.0000	13.6469	3.6800
CH14	1.1667	9.9362	3.2198	3.4212	22.8941	0.5304
	119.4844	182.5235	905.4773	5.5878	23.8732	148.0037
	8.7715	38.1579	77.1228	6.2610	1.5015	4.8426
	2.7998	0.4440	4.0952	0.0000	14.4019	3.8879
CH15	0.9805	10.5110	3.1307	4.0848	23.4508	0.4990
	125.4000	182.3121	971.0273	5.5878	25.4689	156.7044
	9.4660	40.4817	84.6456	6.5537	1.6138	5.4285
	2.2833	0.4414	4.3234	0.0000	14.6703	3.8993
CH16	0.8401	10.7456	3.2095	2.4699	22.6567	0.5021
	107.7745	172.2799	986.7678	5.4701	22.7069	165.5483
	9.9829	35.7655	74.5545	6.2234	1.2616	5.3610
	2.6918	0.4435	3.9526	0.0000	14.8771	3.6787
CH18	0.8476	9.9273	3.6930	2.9289	24.8756	0.4543
	118.3671	187.6380	959.8928	5.9816	23.0181	172.9472
	9.1607	39.4214	80.4174	6.4303	1.3013	5.4674
	3.6797	0.3553	4.2164	0.0000	15.2845	3.5184
CH20	1.0011	10.0152	3.0552	2.8529	23.1344	0.4588
	93.9951	194.5281	1010.9309	5.8240	25.8505	151.2435
	8.7379	36.3316	76.3513	6.1474	1.3136	5.0855
	3.3777	0.3164	4.9923	0.0000	13.6334	3.8773
CH21	1.0320	10.5671	3.4363	2.9128	24.0372	0.5736

	114.8053	168.5817	993.5090	5.8331	24.9583	154.8764
	10.1693	40.5578	73.6492	6.3361	1.5887	5.3787
	2.6547	0.2802	4.4464	0.0000	14.4370	3.6427
CH22	0.8514	10.3354	3.5296	4.2475	20.5448	0.5341
	114.7885	149.1801	879.2588	5.0719	21.2172	139.2256
	8.3058	36.9542	72.5941	6.0969	1.4057	5.6581
	2.1198	0.2877	4.1713	0.0000	13.4296	3.3948
CH23	0.7809	9.4812	3.0570	6.3073	23.6648	0.3906
	108.0037	180.8417	890.7910	5.6593	23.1837	161.2696
	10.4516	39.2639	71.5156	6.5351	1.4415	4.4998
	2.4461	0.4317	4.3138	0.0000	14.6691	3.8446
CH24	0.7557	11.7206	3.5567	3.4731	26.7276	0.4999
	140.5711	200.2490	1081.3191	6.7176	28.4104	166.8797
	11.1410	40.7523	77.9862	6.6569	1.5891	4.8709
	2.8153	0.5539	3.1801	0.0000	15.9882	3.8571
CH25	0.8514	10.6197	3.6513	2.2656	20.7932	0.5079
	128.8118	176.8690	613.4197	5.3608	23.3997	162.1798
	10.7221	35.1111	68.7636	6.1349	1.3858	5.0684
	1.8240	0.4640	3.6597	0.0000	13.0294	3.2429
CH26	0.9279	11.1157	3.1887	3.3376	23.3789	0.5097
	133.5031	179.0099	933.9241	5.6394	23.9657	165.8049
	10.5281	40.1130	78.8794	6.7029	1.8902	5.1843
	3.6493	0.5801	4.5063	0.0000	15.3267	3.6023
CH27	0.7909	12.3603	3.7488	3.5418	24.6012	0.5549
	138.5714	194.8522	1070.4360	6.1646	25.2154	175.1114
	10.5161	38.3638	74.2627	6.6004	1.1366	5.0414
	2.8655	0.4087	3.9671	0.0000	15.3590	3.2181
CH29	1.0282	9.9018	2.3209	3.9480	21.1071	0.5086
	104.5431	170.5286	776.3108	5.0396	21.3770	138.3037
	8.6475	35.7851	68.8533	6.2349	1.5418	5.3152
	2.3717	0.4178	4.5366	0.0000	14.6029	3.2316
CH30	1.0591	10.4735	3.8503	3.7340	22.1523	0.4366
	117.8799	175.3287	918.1377	5.4346	23.6751	159.9900
	9.0851	36.6849	72.2466	6.4655	1.3436	4.5410
	3.3946	0.4317	4.2656	0.0000	13.9368	4.6880
CH31	0.8313	10.7595	3.4168	3.7632	22.1928	0.4922
	126.5727	175.2444	896.7937	5.4383	21.3315	163.6159
	9.7823	34.8274	69.7311	6.1814	1.1717	4.9882
	1.9917	0.3877	4.0034	0.0000	13.9307	4.5419
CH32	0.9791	10.4471	3.2262	2.5637	22.1104	0.4815
	113.9452	177.3450	938.5315	5.4468	23.9164	140.2154
	9.0487	36.2595	72.9100	6.0791	1.2673	4.9761
	2.6193	0.3735	4.7611	0.0000	13.4198	4.4556
CH33	0.9264	10.8612	3.9495	3.4809	25.2515	0.4824
	112.2103	200.0036	972.3569	6.1606	27.6327	173.5704
	11.9117	39.9431	83.6565	6.8264	1.8300	5.4952
	3.3115	0.4164	5.1781	0.0000	15.1942	4.5603
CH34	1.0711	10.3437	3.6651	3.1344	21.3479	0.4756
	127.1548	168.9925	741.8088	5.0269	19.4441	146.7022
	8.6709	36.9838	74.7658	6.5218	1.2335	5.1028
	2.9575	0.4092	4.3135	0.0000	13.2492	4.3636
CH35	1.0549	10.6929	3.5403	3.0981	21.4965	0.4566
	123.2769	173.5459	1010.6770	5.2007	23.8683	142.9718
	9.7017	37.3051	77.6432	6.9084	1.3901	5.0430
	2.7395	0.3954	4.2801	0.0000	14.2492	4.9245
CH36	1.2894	10.7023	3.9438	3.1267	21.9803	0.4581
	127.4496	168.3552	938.3132	5.2010	22.5418	141.4039
	7.8445	37.6352	77.6352	6.1975	1.3037	5.1130
	2.8779	0.3807	4.6333	0.0000	13.2288	4.9581

CH37	0.9831	11.3905	3.4703	2.5050	22.9852	0.5292
	135.1817	209.8761	991.7527	5.5583	23.3773	155.2974
	8.8000	38.8436	81.2546	6.8878	1.5192	5.7372
	3.4212	0.4967	4.7155	0.0000	14.6662	4.7583
CH38	1.0902	10.0131	3.7040	4.6205	21.1851	0.5233
	117.2873	161.0246	871.3684	5.0644	20.4745	138.3465
	8.6662	37.8712	77.2512	6.4041	1.3075	5.0212
	3.4627	0.4092	3.9850	0.0000	13.1697	4.4262
CH39	2.2129	10.0940	1.8803	4.4923	18.0457	0.5013
	89.8206	148.9601	878.5491	4.7506	19.0497	59.0808
	6.9513	36.7355	74.9381	6.2329	1.1741	5.6344
	2.5963	0.4152	4.2359	0.0000	12.2433	5.0767
CH44	1.2414	10.8722	3.7230	3.3925	24.0162	0.5142
	117.8769	186.3293	930.6150	5.8952	24.0093	160.4367
	10.3625	38.1246	78.2879	6.4373	1.2828	5.1817
	2.6943	0.4006	4.3586	0.0000	14.3084	4.5915
CH45	0.7098	11.7366	4.4146	4.1082	24.5673	0.4641
	146.3230	195.5335	1004.9221	6.0731	24.9835	168.7839
	10.0835	36.7682	75.7615	6.1408	1.3334	5.1770
	3.5533	0.3696	3.8594	0.0000	14.2016	5.0783

Black Glaze sherds from Elis.

ELI01	0.7190	8.5850	1.7050	5.8430	23.9358	0.3807
	132.7690	391.2847	1170.7981	5.6618	34.4436	127.4689
	5.8510	36.1510	65.4594	6.5522	0.0000	4.4440
	2.9830	0.4609	3.6830	0.9830	11.0554	2.4013
ELI02	0.8478	7.5930	1.9070	6.0560	18.6945	0.4658
	85.8280	276.4465	1165.2690	5.0728	27.8934	65.4202
	2.3756	28.8275	61.5441	5.2884	0.0000	4.2250
	0.8210	0.3798	4.8025	0.7977	10.7791	1.8402
ELI03	0.9608	8.5050	1.7990	4.2700	22.4615	0.4878
	116.4910	299.4604	1234.0530	5.9625	33.9301	101.4970
	3.5497	34.0788	66.2992	6.1926	0.0000	3.9940
	2.8042	0.4417	4.5890	1.1490	12.2910	2.5519
ELI04	0.8696	7.8870	2.2550	5.4460	21.2938	0.5013
	93.9770	285.7964	1008.8350	5.5573	30.8137	127.4070
	6.0365	30.7122	60.8160	5.6297	0.0000	4.8340
	3.0016	0.4105	4.1770	1.0613	11.0234	1.8676
ELI05	0.4215	7.2290	1.3770	1.3710	18.1882	0.4409
	113.8050	531.7563	1052.3960	5.1655	30.8556	84.6604
	4.1865	34.2070	64.5126	6.1194	0.0000	5.0920
	0.8539	0.4377	4.6220	0.9652	10.6261	2.0809
ELI06	0.7796	8.5220	1.9860	6.2460	22.1658	0.4654
	115.3660	293.8921	1032.9241	5.9097	31.7294	95.7382
	4.0347	30.8909	61.0112	5.3228	0.0000	4.4100
	0.8257	0.3820	3.9023	0.9130	11.6120	2.0484
ELI07	0.9360	7.8610	1.5040	5.6800	21.6218	0.4216
	110.0480	334.6309	1119.3511	5.7678	32.3838	111.0175
	5.0150	33.4982	68.2763	6.2328	0.0000	4.7300
	2.6261	0.4495	4.5790	0.9576	11.6464	2.0114
ELI08	0.9209	7.8510	1.2850	3.8200	20.1877	0.4553
	99.2480	375.7913	1045.1931	5.5190	29.4568	102.1924
	4.4259	30.5303	62.7465	5.5955	0.0000	4.2970
	0.7653	0.4059	4.5707	0.9089	11.8011	2.4207
ELI09	0.8568	8.2960	1.8660	5.2600	20.7650	0.4816
	104.9750	312.7832	1119.1311	5.7132	28.0462	88.4791
	4.3434	29.4280	59.8947	5.2862	0.0000	4.6900
	0.7554	0.4037	3.9354	0.9736	11.2440	1.9484

ELI10	0.9083	8.4630	1.0020	5.0480	21.3464	0.5190
	92.6060	319.3633	1178.4761	5.7341	33.4671	102.1268
	4.7662	30.4957	63.7043	5.4721	0.0000	4.9910
	2.9658	0.4137	4.1870	0.7849	11.6825	1.9728
ELI11	0.9399	8.2150	1.7480	5.2910	21.5737	0.4615
	99.9260	296.1357	991.8669	5.6677	29.0523	83.1540
	3.2075	32.8743	65.3406	5.8611	0.0000	4.5460
	0.8984	0.4153	3.9665	1.1187	12.2162	2.1971
ELI12	0.9408	7.8730	1.6730	5.1320	22.5448	0.4656
	96.1290	376.7705	1115.4939	5.8668	33.3128	128.4095
	4.6779	31.7110	61.8147	5.7092	0.0000	5.1450
	2.6940	0.4616	4.3010	0.9307	11.6427	1.9946
ELI13	0.9847	7.8530	2.3530	5.5350	21.3568	0.5158
	102.7780	322.4988	1078.1201	5.5852	32.0707	156.5358
	6.5944	32.9453	65.9516	6.0085	0.0000	5.3270
	2.5838	0.4060	4.9613	1.0474	11.7170	1.9602
ELI14	0.8929	7.8070	1.8440	5.4110	21.6908	0.5214
	99.8000	293.1235	1002.0471	5.4863	29.6679	88.2727
	3.6358	34.7238	67.6838	6.2270	0.0000	5.1900
	0.7658	0.4253	5.1325	1.2813	11.6973	2.1687
ELI15	0.8414	8.2390	1.9000	4.9880	22.4268	0.4891
	117.6300	293.9465	1170.2329	5.7850	34.2541	119.2735
	5.6246	32.3247	68.0065	5.9147	0.0000	5.4790
	2.3494	0.4386	4.7320	1.1552	11.6710	1.8683
ELI16	0.9597	8.0790	1.6810	5.5160	21.4106	0.4558
	102.6100	318.4937	1112.9619	5.6433	29.3650	123.3656
	5.1852	33.2640	65.2299	6.1451	0.0000	5.1650
	0.8622	0.4377	5.0486	1.0758	12.3147	2.1533
ELI17	0.8359	8.7630	1.9500	4.7000	22.0567	0.4250
	118.4690	309.8640	1101.6809	5.7368	28.9655	80.5151
	3.6749	33.7663	65.3503	5.9734	0.0000	5.7320
	0.9259	0.4237	4.7912	1.2917	12.1427	2.2447
ELI18	0.7690	6.2880	1.3580	6.2680	23.7102	0.4441
	100.0320	477.5522	1115.7209	6.2331	33.3675	90.0370
	3.3767	34.7961	69.2512	6.0117	0.0000	5.1610
	0.8672	0.4259	4.3169	0.9850	12.5502	2.4327
ELI19	0.8749	8.2420	1.4730	5.3100	21.4938	0.4596
	103.7060	335.9089	1145.9399	5.7354	31.8063	115.8799
	4.9364	30.2665	61.9403	5.4407	0.0000	4.8130
	2.5144	0.3922	4.4490	0.8261	11.2052	1.8244
ELI20	0.8983	7.9160	1.7340	5.5080	20.6448	0.4077
	108.9330	438.5002	1077.3950	5.4365	28.2260	111.2995
	5.3613	31.8102	60.2612	5.6646	0.0000	5.5390
	0.8392	0.4079	4.5395	1.0671	11.6984	2.4997

Black Glaze from Eretria.

E01	0.6966	11.2160	4.1510	2.6360	25.5019	0.4654
	146.5200	166.9235	1019.3789	6.0023	23.8388	185.2874
	10.1952	36.1176	72.8777	5.8267	1.3273	4.4920
	2.5915	0.4527	4.4036	1.1117	15.7121	2.6790
E02	1.0079	10.0900	3.9720	2.7300	22.0622	0.4554
	121.9770	160.2597	903.3430	5.3363	20.7603	162.1814
	9.2237	38.5576	78.7354	6.6509	1.4080	5.4360
	2.7914	0.4750	4.0496	1.0766	14.0483	3.0310
E03	0.9821	10.4880	3.7720	2.7020	24.5274	0.4409
	124.6230	167.2498	901.9500	5.5687	21.9194	178.2555
	9.8936	40.8011	74.2557	6.8053	1.6137	6.0730
	2.7204	0.4731	4.2596	1.0722	14.0262	2.3360

E04	0.8319	9.8950	2.6590	2.9900	22.4786	0.5431
	122.5760	190.1576	992.8069	5.6459	25.6782	165.5366
	9.3373	39.0263	81.6911	6.8076	1.5158	6.6420
	3.2436	0.4836	4.5549	1.1902	14.6174	2.7990
E05	0.9539	10.8500	4.1480	2.6130	23.7219	0.3925
	126.1970	166.0610	914.7380	5.4913	22.6940	167.9588
	9.4842	39.2518	76.1274	6.6179	1.4393	5.6900
	2.9151	0.4395	4.1082	1.0350	14.0846	3.5250
E06	0.7987	9.0590	3.0330	5.9760	22.7673	0.4479
	126.8850	336.1399	1048.7600	5.4802	28.3472	131.7537
	7.6842	36.8210	71.4790	6.0633	1.4420	5.0020
	2.5529	0.4852	5.4746	1.0587	13.2092	3.3870
E07	0.8293	10.7330	4.4260	3.0220	23.9678	0.4851
	122.6510	176.3413	987.9089	5.9453	24.4857	171.2363
	10.2785	37.7398	76.1065	6.2706	1.2109	4.8520
	2.9007	0.4784	4.0354	1.0528	14.9126	3.4480
E08	1.0008	9.7460	3.8750	3.1370	20.7852	0.5171
	112.6320	168.5242	811.3640	4.9903	21.2807	153.6234
	8.8261	40.8597	83.6136	7.0366	1.4481	5.7930
	2.6557	0.5063	4.9608	1.0576	14.2784	3.1020
E09	0.9201	10.7940	4.0340	3.4870	22.4639	0.4705
	107.6610	163.9407	1054.3669	5.4293	24.1543	171.4759
	9.3647	38.9584	77.6928	6.7281	1.4217	6.2340
	2.9699	0.4645	4.2402	1.1873	14.8336	3.0660
E10	0.8274	9.0170	3.3540	5.2520	22.2718	0.4957
	114.7660	260.1111	1059.9109	5.1509	24.8554	158.8604
	8.4364	38.1491	74.6995	6.3640	1.5645	6.1690
	2.7126	0.4948	5.1230	0.9941	13.7564	2.3320
E11	0.3432	12.5400	4.0820	2.2640	21.9230	0.5151
	158.7300	188.7096	251.3200	3.2948	10.2862	203.5191
	30.0306	51.5194	99.4796	7.6570	1.4233	6.5450
	3.4165	0.5776	6.6298	1.5381	20.9258	2.3140
E12	0.8540	8.9740	3.1980	7.1280	22.5688	0.4379
	132.9020	305.7664	1068.2720	5.3738	28.4113	131.4462
	8.3373	35.1512	70.7779	6.0148	1.2624	5.4390
	2.5815	0.4810	4.8244	0.8731	12.8192	3.3060
E13	0.9167	9.8500	4.5350	3.1650	23.1245	0.4398
	115.1460	163.1645	949.8020	5.5541	22.9163	162.4736
	9.6224	38.1263	79.9619	6.5560	1.2727	5.5820
	2.9984	0.5035	4.5040	0.9649	14.2567	2.5120
E14	0.7404	10.7360	4.0830	3.7690	23.6084	0.3628
	118.9580	208.5881	968.1030	5.3259	24.4217	180.2475
	9.6209	37.9085	76.9842	6.1853	1.3135	5.6860
	3.0789	0.4903	5.3646	1.0329	14.8588	3.6550
E15	0.9606	8.4590	3.5950	3.6220	19.1117	0.4334
	110.4780	161.9563	772.2451	4.6139	19.9775	133.5055
	7.2157	35.6429	69.5140	6.1179	1.2173	5.0990
	2.7752	0.4461	4.6560	1.0518	12.4715	2.5070
E16	0.6643	9.1320	4.0460	4.7550	25.4272	0.4507
	128.9790	277.5940	1091.2681	5.8222	27.0750	171.9941
	9.1423	35.4760	68.6478	6.1110	1.3521	5.0440
	2.5479	0.4827	4.4032	0.9831	14.2259	3.6450
E17	0.6660	8.4610	4.0160	4.0480	24.9207	0.5146
	115.3660	293.9875	1201.7051	5.7696	29.3649	178.9243
	9.6779	36.5589	71.8528	6.1738	1.5755	5.0500
	2.8983	0.4997	5.0156	1.1010	13.9834	3.1470
E18	1.1144	10.9750	4.0420	3.0600	26.1447	0.5120
	128.7540	176.3937	945.6001	5.7942	24.9035	173.8365
	9.8747	45.5947	84.8867	7.7967	1.4494	6.3810
	3.6889	0.5031	4.4824	1.0844	15.2486	2.3530

E19	0.9222	9.5630	3.3890	4.0160	20.0212	0.4381
	110.1230	184.1789	868.7390	4.8227	20.9407	142.4662
	7.7946	37.5332	72.8854	6.3564	1.4503	5.0070
	2.5201	0.4282	4.6672	1.0177	12.9166	2.4580
E20	1.1423	10.2050	5.1960	3.3320	23.5405	0.4730
	121.3750	172.0989	965.2080	5.2003	23.1690	158.5579
	9.5300	42.7997	81.9480	7.5211	1.4632	6.5770
	2.7260	0.5117	4.8442	0.9232	14.2799	3.6550

Black Glaze from Halieis.

HAL07	0.4274	9.3510	2.2960	4.6940	25.1333	0.5274
	105.8340	703.5752	953.4929	7.1525	46.9302	71.1497
	1.8667	35.0114	73.0264	6.4223	0.0000	4.6628
	2.4552	0.4411	5.0460	1.1143	13.6286	1.7517
HAL08	0.3035	9.0190	2.3290	4.9990	25.2097	0.4776
	120.2390	588.9839	907.8501	6.9180	39.9355	94.7682
	9.8325	36.9427	78.6491	6.8326	0.0000	5.5520
	0.8484	0.5047	4.2382	0.9108	13.2083	1.9670
HAL09	0.3380	8.8700	3.1300	5.9470	22.5033	0.4266
	105.7270	472.7502	790.5691	5.9223	36.7768	106.7086
	8.7018	36.1457	70.5976	6.7486	0.0000	5.1820
	1.1025	0.4765	4.2698	0.8713	11.6489	2.8600
HAL10	0.4327	10.8270	3.5310	5.8650	20.6375	0.5165
	117.1690	149.6137	799.8840	5.0555	20.1992	96.5809
	6.8169	45.7444	89.0364	7.4754	0.0000	6.2920
	0.8109	0.5305	4.7361	0.9930	16.4884	3.9040
HAL11	0.4440	8.4910	1.0070	7.5480	22.4701	0.5095
	123.1490	242.0429	951.2781	5.7653	30.5747	37.7596
	4.2179	35.0536	61.7764	6.0562	0.0000	4.6130
	0.8800	0.4873	3.6320	1.0931	11.8010	2.0360
HAL12	0.3840	8.2190	3.6950	4.5300	23.4396	0.5122
	90.3630	500.5876	754.3020	6.2243	38.0633	89.4489
	7.0652	36.7247	81.4389	7.2997	0.0000	5.7960
	1.2944	0.4332	4.8420	0.9020	12.7747	1.9440
HAL13	0.2766	9.5550	3.0050	5.8280	25.5346	0.5173
	103.5400	541.4053	898.1360	6.5659	38.9146	105.2541
	9.3486	34.9987	78.1721	6.7878	0.0000	5.3450
	1.0457	0.4960	4.4268	0.6230	13.0259	2.9420
HAL14	0.2980	9.1170	2.1310	5.7280	24.4688	0.5132
	109.9270	544.5940	910.7190	6.3435	38.4865	87.6472
	7.1878	38.4160	83.2850	6.9227	0.0000	5.0890
	1.1678	0.5061	5.0490	0.7633	13.1460	2.1100
HAL15	0.4395	8.7490	1.8530	4.0180	21.2277	0.4095
	96.3810	270.8069	1374.6860	5.7661	33.7571	67.3852
	3.9983	41.4610	76.3367	7.2418	0.0000	5.2980
	1.2577	0.5611	5.3407	1.2016	13.5849	2.0900
HAL16	0.3140	9.1500	2.8030	4.3200	26.4994	0.4943
	123.9990	578.8643	771.5720	6.4978	39.2919	140.3687
	12.8102	38.6494	79.2136	7.5134	0.0000	6.1570
	1.1204	0.4891	3.8894	1.0515	12.9018	1.5760
HAL17	0.3282	8.2270	2.6870	7.7260	24.5921	0.3685
	99.6120	524.5027	949.7280	6.3287	40.9880	89.0659
	6.6936	35.3823	66.8671	6.1318	0.0000	5.1660
	1.0949	0.4544	4.3057	0.9413	11.2745	1.7660
HAL18	0.6533	8.4300	2.8550	4.6080	23.7558	0.4734
	127.6280	583.0645	952.2319	6.1043	40.8426	125.5617
	10.4026	34.2680	73.2834	6.3869	0.0000	4.3424
	2.8358	0.4210	4.2930	1.0778	12.0292	1.9293

HAL19	0.2824	8.9140	1.9150	5.4360	21.9375	0.4639
	101.8210	295.6428	1695.6279	6.2623	37.7271	62.2615
	5.1961	46.7395	83.8002	8.1227	0.0000	6.2290
	1.3733	0.5123	5.5839	1.0498	14.2450	4.8950
HAL20	0.3309	7.8320	1.2250	4.0360	19.7713	0.4052
	89.2730	291.5955	1366.0071	5.7898	34.4667	62.4461
	4.0136	42.1671	83.6080	7.1479	0.0000	5.8630
	1.0776	0.5000	5.9614	1.1677	14.4026	3.1950
HAL21	0.9055	8.1600	1.8050	5.0550	21.6763	0.5345
	92.0260	359.0874	1653.4109	6.3460	40.1053	45.2500
	1.5062	42.8597	79.1989	7.1992	0.0000	5.2082
	2.8956	0.4841	5.2010	1.1712	13.6945	2.0750
HAL22	0.3542	8.2820	1.7740	3.4880	19.3583	0.4080
	95.1910	282.8284	1320.3000	5.7049	34.0279	55.5119
	3.7201	41.2979	81.0786	7.3548	0.0000	5.8850
	1.1632	0.5323	5.8677	1.3787	14.1811	3.5750
HAL23	0.2097	9.0100	0.4092	6.9170	20.1381	0.4806
	124.8110	283.2837	770.0320	5.5076	25.5629	33.1929
	3.5379	35.1517	71.4672	6.1688	0.0000	4.9660
	0.9055	0.4605	4.9643	0.9915	13.4368	2.9180
HAL24	0.6094	9.2930	1.9620	6.0230	25.4215	0.4227
	108.2080	646.1487	898.2610	6.6676	41.9479	100.7388
	6.3104	38.1437	78.8782	7.1111	0.0000	4.7591
	3.0805	0.4488	4.3590	1.1354	13.3320	1.9919
HAL25	0.3911	8.3260	3.0420	4.6210	20.2660	0.4439
	96.5190	284.9399	1293.5359	5.8454	32.9332	100.4677
	6.1782	40.8914	75.6337	6.7609	0.0000	5.7990
	1.0270	0.4914	5.7201	0.9337	13.7965	3.1370
HAL26	0.2537	8.0780	2.3510	4.4350	19.1768	0.4784
	94.6150	252.6290	1195.3459	5.2762	29.2959	84.5957
	6.4799	39.8529	73.3983	6.4235	0.0000	4.8530
	1.0981	0.4553	5.2449	1.2072	13.0480	2.8920
HAL27	0.4820	9.4410	3.4840	4.2900	24.8643	0.5406
	133.7280	661.5110	904.8911	6.8025	43.2374	100.9374
	7.8663	36.7226	81.0722	6.8261	0.0000	4.6737
	2.9812	0.4607	4.2080	1.0537	13.4845	2.0333
HAL28	0.2988	9.7290	2.2410	3.8870	24.0428	0.5344
	86.2300	341.4043	1859.9390	7.3624	45.2775	60.1084
	3.8753	50.9532	96.7148	8.4453	0.0000	7.2370
	1.2867	0.6294	6.0584	1.3790	16.1082	2.6830
HAL29	0.3160	8.2110	1.4980	2.0160	20.7382	0.4711
	104.3760	306.6279	1297.9331	5.7620	32.8944	100.5612
	6.4407	38.5443	76.4972	5.8638	0.0000	4.6930
	0.9261	0.4746	6.3023	1.2556	13.5901	2.5480
HAL30	0.2056	7.3320	2.3660	2.0790	21.5010	0.5029
	105.4310	308.5996	1327.4751	5.7402	36.0641	85.4949
	5.2836	40.4637	73.2008	5.8414	0.0000	5.8610
	1.3038	0.5345	6.8243	1.4382	13.1682	3.2790
HAL31	1.1282	7.9560	2.3480	4.5100	18.8987	0.4264
	96.2140	309.6201	1313.0830	5.2061	33.6281	102.6276
	6.0493	35.2370	69.2436	6.0584	0.0000	4.4503
	2.6159	0.4240	4.4870	1.0178	12.1345	2.0896
HAL32	0.9858	8.1200	2.2320	5.4810	19.0898	0.4144
	90.4690	274.8535	1288.4541	5.3040	30.7939	97.4488
	5.3954	36.6725	71.3657	6.2992	0.0000	6.3830
	0.7505	0.4421	4.9237	1.0231	12.6360	3.2250
HAL33	0.5570	8.1560	0.5755	7.5560	18.2182	0.4113
	102.0860	440.9209	1187.5979	5.7263	42.9262	51.2379
	3.7649	34.0721	68.1920	5.3240	0.0000	4.2780
	0.6010	0.4165	4.3062	1.0444	12.2846	3.6110

HAL34	0.7732	8.9420	1.6780	4.5330	19.9195	0.5133
	90.7450	311.0920	1285.2080	6.0789	35.5094	74.2410
	3.4002	36.6831	70.7933	6.1764	0.0000	4.6259
	2.9931	0.4273	4.3460	1.1821	13.2222	1.9293
HAL35	0.6900	8.6300	1.4880	2.3360	21.8675	0.4997
	90.0290	290.9517	1359.4099	6.2286	34.0284	46.8280
	3.1533	39.1036	79.1010	6.0833	0.0000	3.5130
	0.8241	0.4742	6.6754	1.4844	13.4646	2.8890
HAL38	0.8250	7.8660	3.1060	6.8920	19.1395	0.4498
	96.6530	190.6439	1179.1050	5.1625	22.8306	71.3302
	4.1864	29.0791	59.2150	5.5791	0.0000	4.0820
	0.6124	0.3845	4.2289	0.9070	10.8591	2.5830
HAL42	0.8473	9.8700	3.4960	4.3600	17.7107	0.4283
	104.8710	136.5448	735.9651	4.5305	18.3724	126.0552
	7.8347	38.9558	73.5046	6.5030	0.0000	4.2884
	3.0662	0.4519	4.6100	1.1339	14.7645	2.6360

Black Glaze from Iktanu, Jordan.

IK6	0.5693	8.6470	3.3310	5.1920	23.0481	0.3428
	114.7580	446.6809	771.2881	5.3265	33.3674	148.8027
	11.8814	34.0772	67.6386	6.5089	1.3512	6.5650
	2.8332	0.4854	3.8061	1.0574	11.0248	2.4700

Black Glaze from Lachish, Israel.

LA01	0.6130	8.3984	3.1121	4.4372	25.7690	0.4940
	119.1280	664.8542	977.2822	6.4738	40.2173	155.7966
	14.3332	36.6286	79.2296	6.4986	1.4573	5.3998
	2.7501	0.4516	4.2657	1.1528	12.4795	3.0952
LA02	0.5214	8.3769	3.0851	4.6750	24.0149	0.5620
	108.0997	502.7578	689.8950	5.8725	36.6679	169.6705
	12.5380	35.7272	71.8913	6.8132	1.3496	5.3199
	2.6181	0.4239	4.0610	0.7764	12.5166	3.7267
LA03	0.6148	7.8463	3.3428	6.5703	22.2633	0.4881
	118.1417	523.2771	931.4539	5.3933	34.9934	137.7582
	10.5044	33.3275	69.1544	6.1484	1.3045	5.2952
	3.1520	0.4327	4.8625	0.6192	10.9862	3.2031
LA04	0.5534	8.3561	2.6813	4.2134	23.7115	0.5146
	106.4188	565.7612	833.7749	5.9602	35.8562	152.3380
	12.5353	34.4064	74.8655	5.7411	1.5004	4.7773
	2.5584	0.4640	4.1638	1.1074	11.6614	3.1234
LA05	0.9229	7.2700	2.3860	4.6920	21.7103	0.4288
	109.6385	741.0925	746.2698	6.0897	44.4046	123.5781
	7.1019	27.5593	54.8165	4.9487	1.1447	4.2927
	2.5508	0.4186	3.6351	1.0045	10.3895	3.0916
LA06	0.5614	8.3105	3.0362	4.8808	26.1765	0.4850
	129.0644	685.0396	967.9675	6.6560	41.1584	167.8737
	15.0985	36.6275	77.7260	6.7451	1.5397	4.9280
	3.0167	0.3776	4.4913	0.9043	13.0137	2.9961
LA07	0.5369	8.6070	3.0390	4.4698	25.3650	0.5302
	123.4416	527.2573	695.7146	6.2490	40.3591	155.4000
	12.3015	36.5733	74.2416	6.5130	1.6421	5.8988
	3.0198	0.4595	3.7679	0.7887	12.6276	3.7619
LA08	0.5628	8.7201	3.1070	4.3740	24.5118	0.4621
	117.6944	515.7947	712.7959	6.0253	36.7276	177.3097
	13.7939	35.9733	73.5452	6.9314	1.4699	5.5285
	3.3665	0.4268	3.3649	0.9722	12.7406	3.1913

LA09	0.6186	9.3205	3.3300	4.7475	25.4107	0.4989
	125.7117	527.0190	754.4861	6.2112	39.2328	171.4806
	12.5330	37.1361	77.9155	6.7199	1.3824	5.5462
	3.3088	0.4562	4.6682	0.8664	12.3511	3.2660
LA10	0.6436	8.7468	3.0757	5.5477	23.7853	0.5089
	114.7528	578.3474	854.4839	5.8490	37.8627	158.9407
	12.2767	36.8763	72.7251	6.4858	1.2920	4.9620
	2.6706	0.4617	4.3311	0.7794	12.0042	3.1995
LA11	0.5251	8.6797	3.1423	5.5869	27.0835	0.4661
	131.9599	671.1887	747.2952	6.7729	42.1341	181.8280
	14.9034	37.4083	79.9782	6.5445	1.7360	5.5408
	4.0318	0.4722	4.5156	1.2288	14.3253	2.9252
LA13	0.8498	8.0892	2.6889	6.2195	23.3826	0.5166
	120.4663	246.7608	1189.0000	6.0506	29.5889	157.3035
	9.0141	39.0688	86.5936	6.3800	1.7074	5.1625
	3.4575	0.3941	5.3625	1.3626	13.7380	3.9957
LA14	0.6869	7.2472	2.2826	7.3897	20.6005	0.4805
	103.4944	207.8177	1172.5991	5.0739	23.4798	134.0825
	8.5371	36.6291	83.4463	6.4344	1.5600	4.2722
	2.9939	0.4461	5.4452	1.3493	13.8244	3.5911
LA15	0.4155	9.9115	3.5775	1.9174	28.3184	0.5081
	163.0254	667.1763	823.9973	6.9893	41.7235	190.0247
	16.7829	32.4174	82.2028	6.2055	1.4442	4.8241
	2.6124	0.4773	4.2519	1.2164	13.9958	3.6671
LA16	0.9995	8.2909	2.9380	3.5077	25.7239	0.4874
	140.2194	669.6243	638.0713	7.0142	45.0686	148.4281
	7.6020	31.2444	65.6898	4.9654	1.2433	3.9091
	2.5407	0.4364	4.6552	1.0466	12.2239	3.1142
LA17	0.4203	9.6665	2.8173	4.2213	21.8872	0.5106
	145.8543	373.9282	586.5999	5.6987	32.0542	141.7572
	11.9784	36.1388	79.1533	5.1759	1.3145	4.6536
	2.7465	0.4005	5.3499	1.1224	15.2430	2.9558
LA18	0.9902	8.4999	3.2350	5.2538	23.8239	0.4671
	138.1416	633.4133	700.9387	6.6881	45.5825	152.5155
	7.9582	27.4181	62.1039	4.9018	1.0761	3.8846
	3.1254	0.4150	4.1607	0.9925	11.9944	3.3630
LA19	1.0043	8.4091	2.4884	5.5812	25.7132	0.4734
	138.6038	919.9941	775.2744	7.2021	52.3191	135.5824
	7.8033	30.3883	63.3700	5.2795	1.4581	4.4285
	2.7515	0.4100	4.4982	1.1239	11.6634	3.3176
LA20	0.7594	8.6412	2.9522	7.3691	19.6294	0.4902
	125.9494	198.2085	1126.2439	5.1788	22.3763	112.9965
	6.9075	36.4047	76.6760	5.9856	1.3524	4.2849
	3.5641	0.3869	4.7594	1.0781	11.3434	4.2606
LA21	0.7759	8.9435	2.8578	7.0933	19.8764	0.5256
	124.1135	213.4559	1290.9700	5.3848	24.0285	150.4828
	8.3648	38.7106	77.9962	6.6415	1.3312	4.8385
	3.0381	0.4466	5.0320	1.2716	13.0395	4.4637
LA22	0.5653	10.2441	3.0794	5.6198	18.4686	0.5012
	118.6584	109.6156	608.8059	4.8931	18.0651	164.2516
	9.3238	40.4609	79.6257	6.3812	1.2046	4.8833
	3.3495	0.4569	4.7877	1.1126	15.5619	3.7197
LA23	0.5005	9.1816	2.2575	10.5804	21.5479	0.4469
	145.9698	326.8777	962.2239	5.2361	28.9729	139.1145
	10.2384	31.1284	58.6558	5.3404	1.3780	4.5555
	3.1716	0.3904	3.5480	1.1571	11.1940	3.3339
LA24	0.4632	9.5433	2.4967	10.7384	21.5829	0.5023
	141.8198	246.8994	842.5134	5.4639	26.4307	150.2220
	10.3888	32.2276	59.6254	5.2095	1.2023	4.5746
	3.1116	0.3837	3.5271	0.9309	10.9361	3.8398

LA25	0.4847	8.3783	2.6970	10.6080	25.7426	0.4209
	141.9262	283.9202	921.1211	6.2878	33.6701	159.9966
	10.8989	34.9726	64.3264	5.3213	1.3604	3.7960
	2.1855	0.4281	4.1370	1.6296	11.4204	4.2128
LA26	0.8397	7.7220	3.2099	2.8872	23.1950	0.4743
	116.4198	581.0352	709.6575	6.3390	43.2057	155.0353
	7.5254	27.8891	62.9210	4.8701	1.4982	3.9893
	3.3987	0.4031	3.4283	1.3680	10.8202	3.9755
LA27	0.5358	8.2909	3.0881	6.6412	23.0008	0.4714
	95.8956	540.4766	997.6599	5.7259	105.9878	132.0099
	11.8260	36.4847	75.8997	6.4869	1.6093	4.8719
	2.3390	0.4226	4.2027	1.0485	12.0165	4.1182
LA28	0.5376	9.2545	3.9233	4.4615	25.2446	0.5182
	121.3140	564.5503	681.9934	6.1625	39.1625	159.8399
	14.4329	35.7997	70.7336	6.8436	1.5065	4.9165
	2.9641	0.2959	3.9371	1.1483	13.0723	3.6735
LA29	0.5769	9.0810	3.2675	4.7584	25.1384	0.4902
	120.0481	630.9763	820.3533	6.2834	37.6063	161.7338
	13.5773	36.8899	76.4097	6.6921	1.2665	4.1881
	3.4816	0.4400	3.8895	0.6690	12.6450	4.3473
LA30	0.6057	8.4408	3.3186	6.1206	21.9148	0.4589
	111.0121	568.5366	942.4514	5.5656	35.7026	141.7272
	12.0272	33.4456	74.4675	6.4352	1.2936	4.8408
	2.1445	0.4459	3.3688	1.5055	12.1057	4.5815

Black Glaze sherds from Nemea.

NEM58	0.5900	7.9130	1.4360	4.9250	18.6932	0.4983
	106.0130	245.8099	1316.0010	5.0072	29.2897	131.8364
	6.6976	38.6587	74.8327	6.4517	1.3563	5.5340
	2.3471	0.4549	4.5539	1.3377	12.9748	2.8482
NEM59	0.6416	8.5680	2.5720	3.7750	22.1790	0.4915
	116.5330	282.2849	1346.7361	5.9010	34.8222	128.9119
	7.7553	43.7972	85.2098	6.7874	1.7374	6.3700
	2.7657	0.4020	5.1383	0.9316	13.2349	1.9854
NEM60	0.7052	9.7620	1.7910	5.0230	24.5752	0.5092
	110.4700	329.9343	1548.4021	6.6176	39.8343	114.1625
	5.5075	48.9542	97.1284	7.3795	1.6024	4.9630
	3.9257	0.5887	5.3431	1.1547	15.5792	2.5680
NEM61	0.5269	8.9390	1.4020	4.9160	21.5291	0.4288
	145.8360	323.5884	1405.5691	5.7141	35.0624	109.7358
	5.0695	44.5343	80.9554	7.4009	1.5262	6.4520
	2.1865	0.5304	4.3193	0.8716	14.2730	3.0882
NEM62	0.7272	8.4450	2.5190	4.6540	20.6281	0.4372
	95.5740	301.1648	1550.4790	5.6601	35.9427	105.8144
	5.9908	41.6064	83.1479	7.0360	1.6534	5.5120
	3.1991	0.3821	4.1527	1.2292	13.5617	2.1087
NEM63	0.8105	9.0290	2.6890	4.8080	23.3961	0.5093
	106.7240	279.7292	1152.5669	6.2955	26.3447	68.4141
	2.9858	36.7605	84.4220	6.7417	1.6723	5.4070
	3.0279	0.6072	3.6685	1.2226	13.8506	2.0392
NEM64	0.7873	9.3250	1.1730	4.9480	21.3441	0.4561
	90.6060	260.1548	1291.6111	6.1542	29.4559	36.1000
	1.9141	39.1934	75.8312	7.1678	1.9425	6.9300
	3.1926	0.5266	3.7362	0.8153	13.7604	1.0910
NEM65	0.4094	9.3170	3.0060	4.7850	26.6170	0.5350
	132.3890	658.1926	1091.9780	6.8914	43.7856	105.9358
	8.2058	41.1904	87.7420	7.4517	1.6594	5.7870
	1.5038	0.3300	3.7900	0.8932	12.9760	2.6980

NEM66	0.3056	8.9330	2.4590	8.0680	28.5193	0.4648
	148.0960	339.4514	864.8579	7.2541	37.7890	146.8548
	9.6758	41.3342	83.1309	6.2626	1.3572	4.7630
	4.0670	0.5727	3.7316	0.8928	13.9392	2.5871
NEM67	0.5779	8.7290	3.6440	5.0140	21.4964	0.5032
	124.4450	318.1873	1619.6331	5.7317	36.7740	131.4087
	7.8605	45.2272	79.6289	7.9341	1.4189	7.7520
	3.3931	0.5071	3.8820	1.3400	14.3653	2.8586
NEM68	0.2177	9.9470	0.5427	5.2540	27.2171	0.5151
	137.0510	766.6340	1048.0071	7.3340	45.3746	88.6555
	5.2514	39.9579	83.0398	7.6448	1.2469	5.2250
	2.0805	0.4903	3.3097	1.0389	14.4381	2.5563
NEM69	0.3182	8.7470	2.1060	8.6270	25.9056	0.3940
	147.8590	299.7991	962.7109	6.2104	35.2584	120.9613
	9.9942	38.6382	74.0535	6.1571	1.2019	4.8630
	2.8719	0.4061	2.8505	0.8954	13.0561	3.2028
NEM70	0.5084	9.0500	0.4207	7.0610	23.1437	0.5316
	126.9940	330.6826	1812.1960	6.2209	39.7769	69.3751
	4.9003	46.9364	85.7177	8.4561	1.7750	8.1060
	3.1193	0.5509	3.4269	0.9893	15.2638	3.0633
NEM71	0.5996	8.7290	2.8410	5.4960	22.9056	0.4471
	100.7210	388.6873	1316.3911	6.5421	39.8662	76.1397
	2.7355	46.3008	88.2524	8.0661	1.5106	6.9900
	3.8767	0.5067	3.1837	1.3533	15.5326	3.0722
NEM72	0.4673	9.2550	2.2520	7.2980	24.6460	0.4734
	133.3360	281.4941	1026.2991	5.7980	32.9800	102.4103
	16.3948	39.2388	71.3608	6.1894	1.6211	5.7830
	2.9187	0.5282	2.5987	0.8206	12.2914	3.2235
NEM73	0.7553	7.6330	1.3470	8.2650	20.8647	0.3786
	86.5410	256.8044	987.7749	5.3298	29.5505	79.8906
	5.1535	33.0403	62.6488	6.0264	1.3070	4.0950
	3.4123	0.3541	1.9877	1.0481	11.6833	1.2065
NEM74	0.6617	8.5240	2.4390	4.6540	22.8155	0.4341
	118.8750	315.7305	1613.5801	6.1022	38.5809	136.9452
	6.8406	46.2017	90.9712	7.6051	1.6668	6.4560
	3.1400	0.6873	2.8467	0.9788	13.7572	3.3739
NEM75	0.7272	9.4880	2.4260	3.2760	21.8272	0.4264
	114.7410	279.0759	1189.9871	5.7495	30.9604	129.4841
	6.8358	47.4182	98.8574	7.6420	1.5787	6.5820
	1.9654	0.5067	3.0084	1.1514	14.8829	5.2587
NEM76	0.4791	8.5000	0.8408	6.2430	25.4428	0.3658
	111.6630	391.3689	1400.2590	7.0436	37.8723	74.6979
	4.7211	48.4475	90.1968	7.7971	1.5894	4.7520
	1.3443	0.6456	2.9564	1.0788	14.9736	2.6262
NEM77	0.9629	8.1820	2.2970	4.8210	24.9368	0.5044
	91.0020	309.4033	1227.8411	6.5252	34.0698	104.8569
	5.2573	35.6461	75.1970	6.3200	1.4918	4.3590
	3.3974	0.5264	2.0307	1.1592	13.3194	1.1503
NEM78	0.4583	8.8410	2.7420	5.0010	25.9965	0.4853
	114.8080	635.6934	905.5249	6.6928	42.6053	128.3121
	11.6660	39.1839	83.2578	6.9208	1.3525	4.7830
	2.8016	0.4342	2.0560	1.2227	13.1068	1.5215
NEM79	0.2578	8.9330	1.5620	6.4470	23.6655	0.4638
	139.3440	313.7864	869.6699	6.5327	30.6448	57.5840
	4.3591	35.0923	69.3794	5.9583	1.2541	6.1050
	2.3444	0.4399	1.9056	1.4308	13.2783	3.3540
NEM80	0.4230	10.0840	2.9360	5.7080	26.3128	0.4633
	125.1830	355.9421	1718.4880	7.0336	41.2673	90.4605
	4.6671	50.3620	89.5874	8.4298	1.9271	5.6620
	3.7472	0.6171	2.5773	1.1381	15.9225	2.5694

Black Glaze sherds from Olympia.

OLY01	0.8566	7.2170	1.6450	5.4300	19.4668	0.3457
	96.7180	294.6843	873.4431	4.9736	0.0000	124.9124
	6.0080	28.9315	59.8542	0.0000	0.0000	4.3560
	0.7933	0.3941	5.0113	0.0000	10.2749	2.7710
OLY02	0.5303	8.1770	2.4570	6.7970	24.6879	0.3811
	132.4580	448.9836	1143.5930	6.2922	30.5857	97.9886
	8.6042	30.1602	63.9878	4.8980	0.0000	3.3440
	0.7519	0.4097	3.4029	1.2998	10.6813	2.5740
OLY03	0.5491	6.8340	1.8560	4.0770	18.6748	0.4185
	89.4840	307.7476	1248.1550	5.3214	30.2306	102.8611
	6.1470	30.8253	58.0961	5.2245	0.0000	4.2980
	0.6448	0.4366	4.1733	0.9542	10.6236	2.2710
OLY04	0.4734	7.6150	2.7480	6.6150	20.7546	0.4360
	116.1660	293.3105	1414.7271	5.1650	31.0584	95.9551
	5.2226	36.5260	68.3740	6.4651	1.4526	5.8410
	2.9513	0.4556	3.9125	0.9097	10.7399	3.7710
OLY05	0.1988	5.9430	2.1150	7.1350	19.8539	0.3694
	84.1020	288.7258	1298.9800	5.2329	0.0000	100.1893
	5.2029	34.0378	66.2123	0.0000	0.0000	5.4580
	0.8119	0.4160	4.0986	0.0000	10.5907	3.0720
OLY06	0.2799	7.4390	1.1200	0.1242	13.7781	0.4007
	91.2470	406.1833	188.6660	4.9495	28.5823	107.6525
	6.6509	20.5805	58.2164	3.8380	0.0000	3.7705
	1.4313	0.2732	2.6890	0.8187	9.9824	1.3852
OLY07	0.5298	8.0940	2.2120	5.1290	23.5540	0.3894
	132.4690	705.5442	973.9651	5.6206	36.2527	130.7488
	7.9156	34.9318	64.2110	6.3826	0.0000	4.9006
	3.2772	0.4304	4.2790	0.9376	10.6678	2.3312
OLY08	0.3408	9.3500	2.9690	5.2520	25.1145	0.5909
	124.4060	313.4443	1218.9971	6.6186	0.0000	119.4623
	5.2998	41.1841	76.7603	0.0000	0.0000	7.0320
	0.8450	0.5149	4.3425	0.0000	14.2442	3.0400
OLY09	0.9164	8.2300	1.5790	4.7360	23.6980	0.4287
	111.9790	298.6584	1122.6980	6.0019	0.0000	146.3777
	7.9945	36.9521	74.7980	0.0000	0.0000	6.1100
	0.9171	0.5005	4.9174	0.0000	12.7853	2.8490
OLY10	0.7741	6.6280	1.1530	13.2120	21.8763	0.3019
	74.8990	288.1135	1294.6169	5.5983	0.0000	92.0995
	4.5706	32.4570	63.9902	0.0000	0.0000	6.2890
	0.8316	0.4432	4.5023	0.0000	11.6846	2.5220
OLY11	0.9708	8.3380	1.7690	7.3940	22.1077	0.4509
	113.1420	273.0193	1167.7471	5.6030	31.8480	112.3311
	5.5358	33.8499	62.2137	6.1037	0.0000	4.2641
	2.4903	0.4663	4.3860	0.7513	11.4421	1.7892
OLY12	0.5242	7.5690	2.6800	6.5630	21.1986	0.4700
	85.1820	244.1389	1512.0010	5.4798	34.0953	90.1850
	7.0294	37.4406	70.7523	6.6244	0.0000	6.4540
	0.8799	0.5230	4.1210	1.2769	11.5846	2.7080
OLY13	0.8261	8.4260	1.8470	5.1680	20.5481	0.4768
	100.5750	272.0073	1142.4971	5.3793	27.1190	119.0954
	6.8322	29.0242	56.9081	4.8691	0.0000	3.9490
	0.6382	0.3972	4.2791	0.8434	10.0573	1.9610
OLY14	0.4176	7.9120	1.8700	8.7780	20.5641	0.4309
	99.2920	285.1462	1316.1841	5.2826	0.0000	118.7258
	6.5583	39.3040	65.0484	0.0000	0.0000	5.4080
	0.7645	0.4592	3.5634	0.0000	11.1877	2.7860

OLY15	0.5679	8.9240	3.0500	4.5800	17.4638	0.4350
	125.4270	661.6460	809.8101	6.3094	38.5235	151.1882
	12.8378	32.9184	70.4325	5.6901	0.0000	4.0968
	3.0205	0.4214	3.5770	0.9252	11.8054	1.9979
OLY16	0.2885	8.5920	2.3310	4.9410	23.5860	0.4288
	129.0060	281.1509	992.7471	5.7898	0.0000	156.3447
	7.7028	34.5628	64.5432	0.0000	0.0000	4.9920
	0.7886	0.4466	4.0761	0.0000	11.5834	2.1850
OLY17	0.6099	8.1480	2.1630	9.0490	14.6540	0.3582
	145.3810	355.3354	1257.5610	5.2542	15.2173	97.4294
	5.3194	22.8847	59.6355	4.2350	0.0000	3.9363
	1.7837	0.3062	5.1540	0.9729	9.6471	1.5630
OLY18	0.7318	7.4720	2.3880	6.9440	20.3975	0.3114
	104.2230	247.7809	1149.4661	4.9309	25.3364	125.3207
	6.3829	29.5273	55.9649	5.5187	1.1469	4.4060
	2.6457	0.3123	3.3634	0.7310	9.8737	1.1920
OLY19	0.6619	8.2400	2.9420	5.0500	21.2882	0.4805
	116.1890	241.2132	1118.0090	5.8948	32.7908	162.0419
	10.8339	33.5662	87.6112	5.9115	0.0000	4.3970
	0.7943	0.5906	4.6868	1.0519	10.4469	1.3400
OLY20	0.2823	8.7220	1.8060	6.1020	24.4407	0.5293
	98.1290	288.1941	950.3010	6.8391	0.0000	60.1652
	3.4971	35.2823	69.3383	0.0000	0.0000	4.9840
	0.8002	0.4620	4.9609	0.0000	13.3110	1.8840
OLY21	0.3946	5.2360	1.3910	11.1450	15.9936	0.3137
	80.4400	171.3055	1083.7839	3.4237	18.0102	87.2181
	3.7629	22.8116	42.6538	4.2455	0.0000	2.8170
	1.4964	0.2522	2.4020	0.6171	7.0179	1.5297
OLY23	1.0446	5.7980	1.8540	11.1510	16.0264	0.3353
	89.9980	229.0813	1234.3059	4.0555	25.4096	105.7051
	5.6490	27.0370	48.7454	5.0718	1.1944	3.4040
	2.4125	0.3039	3.1565	0.5990	8.1540	2.6890

Miscellaneous vase samples.

POT01	1.3508	10.3835	3.3637	2.8505	23.4090	0.4752
	111.7509	180.5005	921.3057	5.7767	24.7931	158.2526
	8.2130	40.7791	84.3405	6.8804	1.5466	5.2430
	3.0420	0.4928	4.7344	0.8217	14.6556	4.6830
POT02	0.5375	8.0406	2.2523	4.4162	21.5512	0.4669
	132.9393	375.3186	934.0652	5.8430	37.6492	107.1650
	7.1999	28.9812	58.6585	5.1807	1.4764	4.0473
	2.9070	0.3628	3.9963	1.1832	10.5839	4.4955
POT03	1.2821	8.1223	2.3652	3.1333	22.9744	0.5338
	124.8292	326.7339	647.6946	5.6430	26.6111	121.5884
	8.1116	27.8059	62.8720	5.2730	1.5956	4.6515
	2.7210	0.4659	5.1669	0.9192	9.7143	4.1310
POT04	0.5678	7.7691	2.1291	6.4710	21.2264	0.4465
	131.3109	396.8098	912.7852	5.8550	35.7199	125.6728
	7.0748	29.9931	64.3501	5.1943	1.5484	4.6441
	2.2165	0.3343	3.0796	0.8852	10.0210	4.7972
POT05	0.5250	8.0930	2.6272	7.0631	21.3058	0.5075
	122.1494	388.4929	693.0388	5.7527	35.7300	108.4483
	6.5748	29.2714	58.1806	5.0758	1.8129	4.1809
	2.1876	0.4095	3.5976	0.5368	10.9089	3.8578
POT06	0.4316	8.2293	2.4070	7.0167	23.1658	0.4596
	133.3523	395.1770	694.9199	6.2603	38.6547	116.2895
	6.3184	33.2429	64.1015	5.4080	1.4413	4.4410
	2.3478	0.4377	3.6743	0.8214	10.5546	4.1640

POT07	0.3471	8.2853	2.6275	4.1219	25.2058	0.5576
	154.2936	486.5229	964.0239	6.5334	41.0867	106.2412
	5.4066	30.3270	69.4239	5.9319	1.6613	5.2423
	2.4687	0.5171	3.7787	0.7821	9.4030	4.3526
POT08	0.3798	8.5975	2.1971	6.1046	25.7222	0.5626
	131.7698	454.6174	756.3010	6.8767	42.6459	94.9807
	5.1113	33.9320	67.0556	5.3924	1.2817	4.0448
	2.9988	0.3436	3.9927	1.1602	10.7606	4.2095
POT09	0.5923	9.2406	3.3017	4.0118	25.4740	0.4895
	126.5339	553.6338	660.0781	6.2635	36.5005	174.3283
	13.5448	36.0375	72.9189	6.3335	1.3621	5.3952
	2.9413	0.4993	3.7737	1.0405	11.3868	3.6933
POT10	0.4758	8.5052	2.7697	6.1578	21.7662	0.5155
	114.0304	383.4751	781.9900	5.8540	35.9813	118.8695
	6.8006	28.8035	62.5098	4.9839	1.3863	4.0752
	2.2397	0.3736	3.1241	0.9443	10.4612	3.9322
POT11	0.5121	8.6368	1.7488	7.5224	21.8850	0.5191
	118.2177	356.5564	869.5928	5.7419	31.6772	83.3131
	5.0204	30.6651	63.5147	5.3883	1.3659	4.0402
	2.8429	0.4709	4.7102	1.0620	10.9540	4.5995
POT12	0.6095	9.7477	3.0440	4.0194	25.1982	0.5187
	132.0702	503.9824	695.0288	6.1691	35.7380	167.6533
	12.4562	33.8061	68.6860	6.6531	1.7333	5.0604
	2.6685	0.3781	4.3608	0.8941	12.8609	4.1324
POT13	0.5685	9.9266	2.8118	3.7849	24.6398	0.5300
	132.7320	516.8491	660.0564	6.0875	37.2879	170.5670
	14.7600	34.5992	72.8764	6.8734	1.6052	5.4181
	3.0633	0.3940	4.2818	0.7672	12.2379	3.7662
POT14	0.4812	8.3863	2.8514	5.1971	22.2051	0.4673
	127.9130	385.5828	694.1533	5.9804	37.2379	131.1861
	6.2082	29.8127	62.1590	5.3958	1.3203	4.5013
	2.4347	0.4184	3.6254	0.8020	11.2809	3.7047
POT15	0.7875	9.3531	2.7831	6.4283	19.8359	0.4676
	101.5614	349.6101	988.8394	5.3427	34.1145	108.8512
	4.9311	35.3290	52.9551	5.8176	1.2828	5.3686
	3.2023	0.3989	2.6725	0.6708	9.0999	5.0239
POT16	0.5241	8.8046	2.2452	5.7900	27.5298	0.5269
	131.2295	336.2588	736.9502	6.4927	32.1398	171.0774
	10.6007	31.2781	84.9796	5.6699	1.7965	4.6763
	2.3526	0.4741	5.3394	1.2768	15.5944	4.1262
POT17	0.5433	8.9087	3.3510	3.9449	22.6949	0.4755
	132.4481	522.3833	825.5779	5.7216	33.5591	148.9447
	11.3562	31.3156	63.0003	6.2921	1.5290	5.0494
	2.5862	0.4639	3.9216	0.9779	11.2990	4.2748
POT18	0.7214	9.5463	3.0508	2.8894	26.6218	0.5443
	138.3599	630.6975	739.6296	6.5978	36.5611	170.9780
	13.8124	38.4554	81.8837	6.9260	1.5847	5.4666
	3.7311	0.5098	4.0572	1.0282	13.1326	4.5708
POT19	1.0512	10.5934	3.2609	2.7750	23.4090	0.5421
	123.5475	159.1750	915.5574	5.5077	22.5121	162.5868
	10.2030	42.4674	87.0906	7.3009	1.6074	6.2172
	3.3254	0.5072	4.6378	1.1241	14.7967	4.7215
POT20	1.0019	8.6688	2.5622	2.6808	20.6018	0.5742
	138.1131	343.2634	704.9585	5.5473	30.3165	130.6166
	7.0755	31.7505	69.8719	5.3122	1.4285	4.2321
	2.9507	0.4327	4.2348	1.6112	11.3919	4.2051
POT21	1.0231	8.6644	2.4635	2.3460	21.7935	0.5775
	130.7889	402.1909	650.1768	6.1130	30.7855	134.6148
	6.3661	33.5942	74.8878	5.4111	1.3305	4.1914
	2.7333	0.4172	4.7656	1.1307	12.0910	3.7437

POT22	1.0929	7.9018	2.6607	8.1273	25.8165	0.5323
	132.2493	335.1189	1540.3181	6.1731	30.1119	89.9361
	5.5155	30.2091	63.5211	5.9414	1.5621	4.2817
	3.0868	0.4362	4.8756	0.8967	8.7283	6.5445
POT23	1.0796	10.9619	3.4748	2.3946	22.1239	0.5256
	117.5438	231.8666	961.9292	5.4099	22.0991	157.3013
	9.0358	36.7654	74.4470	6.2599	1.3443	5.6253
	2.9180	0.4945	4.3038	1.1544	14.1524	4.8138
POT24	0.6258	8.4615	2.7882	8.2886	21.6456	0.4399
	126.1168	532.6079	847.8193	5.4911	34.0628	137.0291
	12.2935	29.0765	62.5982	5.8853	1.4154	5.3690
	2.1974	0.3954	3.8656	0.7739	11.3461	4.4635
POT25	1.0629	8.0587	2.7708	3.3458	18.2211	0.4869
	94.3604	299.9915	702.0366	5.0218	26.8004	105.8805
	5.1237	28.1277	61.7136	4.9597	1.0193	4.1639
	2.8371	0.3126	3.8565	0.0000	10.8225	4.1880

Black Glaze sherds from Sparta.

SP16	0.3181	9.3710	1.4960	5.0390	20.1045	0.5695
	98.1750	219.6712	1561.1240	6.0099	27.6439	38.9433
	0.5143	50.3667	94.8816	8.3615	1.7592	4.9960
	3.3852	0.5780	6.7730	1.7498	15.9784	4.5740
SP18	0.6206	9.4930	2.0000	4.9190	20.9841	0.5338
	132.1200	327.7571	683.1770	5.4705	30.1123	52.1885
	1.3251	38.3970	79.8072	6.4124	1.5339	6.3150
	3.2411	0.4525	5.6890	1.2193	14.6900	2.1932
SP24	0.2935	10.9010	1.1830	2.4350	19.6192	0.7096
	77.8640	162.6201	903.5349	6.1027	21.9450	60.8142
	2.4172	55.9320	105.6799	10.0753	1.8452	7.4920
	3.6512	0.5885	8.1278	1.7572	18.5550	3.2070
SP27	0.2617	9.7040	1.0030	3.3410	19.3780	0.6198
	65.3250	199.3394	1234.7329	6.0473	27.9213	29.2232
	1.3522	50.9621	98.3941	8.6485	1.7691	5.7590
	4.1318	0.5931	7.5914	1.5547	17.1226	4.8490
SP28	0.1627	7.9770	0.3691	2.8310	13.4366	0.5069
	52.1270	141.5750	142.2780	4.1635	12.2719	31.7330
	2.0798	46.9752	80.6995	7.5128	1.4638	6.1080
	3.2274	0.4510	6.3476	1.0891	14.7140	2.2418
SP29	0.2368	11.1610	0.8107	3.6600	18.9917	0.6276
	84.7740	180.4925	953.4241	6.1300	27.0560	28.3129
	1.1287	53.8252	109.0849	9.3296	1.7507	8.3470
	4.1790	0.6174	8.0746	1.6660	18.8338	5.1680
SP30	0.1646	8.1030	0.8728	2.9850	13.3852	0.4458
	63.5380	136.1732	157.8910	3.9534	11.2654	39.3626
	2.2332	46.7292	70.9035	7.5481	1.3794	5.8790
	3.1889	0.4777	6.3041	1.2966	14.2909	2.5370
SP31	0.6597	8.0790	1.7150	3.6560	21.3998	0.4517
	90.3720	347.5347	1042.3879	6.2083	22.6013	39.2714
	0.7633	41.4987	80.6922	7.1837	0.0000	3.1866
	0.5258	6.9690	6.9690	1.3647	15.0199	2.5474
SP32	0.3415	11.8940	1.6510	1.9240	23.7469	0.6728
	99.1190	256.3950	462.7791	6.2445	22.9356	28.6595
	0.5447	43.6316	86.3808	7.5655	1.4296	6.1280
	3.6868	0.5768	7.3214	1.9297	16.7631	5.1470
SP33	0.3042	12.5000	1.9150	1.3470	22.0819	0.7685
	100.8550	150.1938	1038.7009	6.7795	30.4693	56.4124
	2.2109	63.1838	122.2596	10.5048	1.9423	8.1230
	4.2656	0.6720	8.8829	1.7511	20.0428	4.8090

SP34	0.1224	11.2550	0.8369	0.4117	23.6049	0.6919
	146.9410	311.6482	945.5620	7.4158	37.9551	87.2368
	3.6595	50.8214	102.5421	9.4596	0.0000	4.6459
	0.6445	7.9910	7.9910	1.6598	17.7452	2.8002
SP35	0.3679	13.5290	1.1560	2.1250	24.0784	0.7004
	87.0920	182.3628	958.1941	7.9938	29.3038	60.2400
	2.1224	74.3571	139.9402	12.1965	1.9670	7.9900
	4.5634	0.6973	9.0149	2.2032	25.3829	4.4380
SP36	0.4182	10.3760	1.9430	3.0910	23.1476	0.5413
	70.4260	318.8633	1042.5210	6.7617	33.2628	43.5390
	1.2959	45.6601	92.0506	7.8670	1.4853	6.9230
	4.1283	0.5655	6.8309	1.5068	17.0781	1.9130
SP37	0.4980	9.7010	1.8620	4.9860	23.6857	0.5788
	108.9070	352.7314	920.2639	6.1280	41.2666	37.3702
	0.7382	41.6877	84.6225	7.0920	1.4651	5.7020
	3.6196	0.5578	6.1448	1.3281	15.6754	3.4840
SP39	0.3379	11.0680	0.9022	3.7950	22.6128	0.5872
	120.6360	259.9146	950.8391	6.4429	19.7910	53.3108
	1.9840	48.0281	99.5515	8.1807	0.0000	7.1620
	3.5844	0.5827	7.2470	1.9376	18.1193	4.0940
SP40	0.3352	9.9160	1.5240	3.7260	18.7421	0.6540
	123.5910	229.5625	768.1531	5.9775	26.6894	29.4557
	1.1328	55.4711	98.2684	9.1523	1.7805	7.1250
	3.4081	0.5532	7.2959	1.5829	16.9169	4.6440
SP41	0.3349	9.4000	0.2395	6.1640	20.4752	0.6154
	81.9580	223.6504	1834.0869	6.5432	31.4662	35.2071
	0.3031	48.4664	93.4398	8.3420	1.5397	7.2950
	3.5622	0.5498	6.5908	1.5238	16.8193	5.5230
SP42	0.3533	9.7640	1.0690	2.6930	20.4151	0.5585
	112.6140	270.5520	1226.1411	6.1378	29.2771	37.9628
	0.8808	46.9205	88.1520	8.0108	1.4095	8.0100
	3.3540	0.5379	6.5652	1.5035	15.7674	6.0670
SP43	0.3362	9.9220	2.2190	3.8080	21.2408	0.5421
	84.3840	184.6840	1765.3889	6.0291	19.7553	69.8426
	3.2256	60.4378	110.7051	0.0000	0.0000	7.9920
	4.0374	0.6044	7.5830	1.4915	17.3185	5.5230
SP44	0.2859	10.1220	0.4489	2.6470	21.4471	0.5856
	108.3350	299.5967	964.6599	6.1902	31.2451	28.2644
	0.9502	47.5931	89.3195	8.3342	1.9031	7.5890
	3.5890	0.5683	6.8279	1.3585	15.4788	4.0530
SP45	0.2315	11.6250	1.1950	2.5610	20.9797	0.7364
	129.8730	211.7473	1011.0200	6.7300	27.8166	44.4189
	1.5949	63.9894	118.8857	10.6832	1.7648	6.7390
	4.1629	0.6365	8.0416	1.9084	19.6864	5.0770
SP47	0.3272	11.6150	0.8801	2.3220	18.8271	0.7339
	131.6810	178.7059	768.3550	7.0791	18.7230	28.9252
	1.6527	65.4194	129.2208	10.9562	0.0000	8.2360
	4.2735	0.6536	9.4500	2.1381	21.0049	4.6810
SP48	0.3217	9.4170	1.3500	2.8440	18.1553	0.5728
	110.0250	252.4893	770.8020	4.4810	34.8706	34.4070
	0.8247	44.3546	82.2425	7.7565	1.3853	7.1230
	3.2720	0.5221	6.3819	1.5106	14.9409	4.2100
SP49	0.2612	9.2880	1.6380	3.6930	17.9538	0.6490
	115.3990	140.6110	1104.6531	5.9906	21.0749	30.7549
	0.9705	56.0989	110.1687	9.5129	1.8968	8.0280
	3.6802	0.6018	8.6646	1.7526	18.5670	6.2570
SP50	0.3571	10.0900	2.3530	4.0170	24.6021	0.5748
	112.0900	244.6444	965.8030	5.9749	19.5620	58.5813
	1.8360	48.9942	93.9582	8.3141	0.0000	7.0430
	4.5715	0.5967	6.3250	1.7332	16.5360	4.4740

Black Glaze sherds from Tanagra.

TAN01	0.6075	8.4870	2.5630	3.2300	21.6560	0.5190
	145.8510	457.2112	753.7280	5.5336	32.6873	163.6770
	7.3926	29.8051	63.0063	5.1206	1.2766	4.3740
	1.1856	0.3692	3.8440	1.2474	11.3143	2.2960
TAN02	0.8362	8.4380	2.5740	2.6750	21.1884	0.5320
	120.0130	464.3655	796.4209	5.6637	33.0057	141.1940
	7.2653	28.7571	58.9786	4.5853	1.0275	3.6410
	2.2377	0.3999	4.1219	1.0530	10.8377	2.2170
TAN03	0.7212	7.9800	2.3920	4.5290	19.5040	0.4959
	106.8830	421.7456	680.5310	5.3632	30.8049	142.1863
	6.5691	25.1632	52.3992	4.2348	1.0310	3.3410
	1.9149	0.3510	3.7477	0.9781	10.2786	2.4490
TAN04	0.9237	8.8550	2.6810	3.1530	22.9419	0.4548
	124.0090	405.7720	780.3030	5.8414	31.6748	158.4371
	7.4681	30.2379	64.6839	4.8095	1.1003	4.6300
	2.2341	0.4385	4.4758	1.2079	12.1668	3.6280
TAN05	0.6727	9.1680	3.2930	5.0020	22.1954	0.5548
	141.6620	510.2034	810.5161	5.7679	33.7593	145.2950
	7.4529	32.0530	64.3042	4.6681	1.1888	4.1670
	1.3202	0.4024	3.9467	0.6638	11.5619	3.0910
TAN06	0.8815	7.3450	2.4360	2.5680	19.9853	0.4434
	102.7410	524.4575	705.1360	5.3163	33.3860	127.6019
	6.6113	26.9502	52.7664	4.2989	0.9929	3.8230
	2.4256	0.4177	4.2608	1.1250	10.2359	2.7100
TAN07	1.0337	8.6300	2.7060	2.3920	24.1085	0.5077
	117.0290	492.5146	775.2539	6.5313	33.6828	169.4474
	7.4536	32.9225	73.0476	5.1965	1.2012	3.9970
	2.6733	0.3947	4.6599	1.3565	13.3687	2.5060
TAN08	0.8980	8.8770	2.7740	2.5540	21.6266	0.5015
	140.0380	381.5981	599.9409	5.7929	32.1964	161.1387
	7.4414	31.0062	64.2855	4.5678	1.0269	3.7590
	2.2991	0.3716	3.7996	1.1996	11.5737	2.7760
TAN09	0.9217	10.4150	3.1250	2.0410	24.4536	0.4922
	109.0210	185.1575	877.4600	5.9265	22.7322	169.5041
	10.6276	36.4313	76.5021	5.6423	1.3770	5.1890
	2.9699	0.5013	4.0410	1.2543	14.9972	2.7180
TAN10	0.9365	7.9760	2.0980	3.0630	19.6689	0.4286
	108.2990	435.0742	800.7920	5.1840	30.6873	116.3057
	6.3716	26.1116	53.6330	4.3318	1.1964	4.1520
	1.4773	0.3168	4.0938	0.9695	10.4060	2.9500
TAN11	0.6036	8.8310	2.5230	4.2520	24.1911	0.5434
	139.6450	539.8127	722.8989	6.3120	40.6522	154.7119
	7.6185	31.7122	66.6135	5.3991	1.2866	4.1500
	2.4032	0.3868	3.4999	0.9727	11.4117	2.3730
TAN12	0.5200	8.8990	2.5440	4.1060	26.2112	0.5613
	144.7910	539.0288	705.1841	6.8632	41.1008	168.6663
	7.5038	35.0745	73.0236	5.4452	1.2357	5.0790
	2.5418	0.4164	3.5663	0.7999	12.2155	2.5260
TAN13	0.4883	8.8700	2.6500	4.3530	23.5837	0.4371
	149.1670	486.0918	694.0439	6.1340	39.6310	168.5722
	7.5893	30.5636	62.8849	5.0306	1.3071	3.7840
	1.9944	0.3237	3.3201	1.2985	11.2268	2.1260
TAN14	0.5872	9.0490	2.6400	5.7010	24.9953	0.4477
	121.3640	476.5532	889.5801	6.8156	36.3047	121.4761
	8.0944	35.1400	67.7448	5.1677	1.3621	4.3930
	2.5532	0.5081	3.9647	1.1490	13.5028	2.9070

TAN15	0.7016	9.1090	2.5530	5.0630	22.7071	0.4716
	136.7650	441.2380	857.3870	5.9649	32.7867	99.3033
	6.3198	32.6801	61.9157	4.8913	1.1987	4.6420
	2.6654	0.4238	4.0292	1.1126	12.1097	3.8130
TAN16	0.7273	9.6900	2.9020	3.2760	24.1033	0.4870
	138.4270	335.9275	837.7561	6.1628	31.4740	172.4201
	8.9678	36.8281	75.6931	5.9336	1.3177	5.0300
	2.7934	0.4030	4.0010	0.8263	13.5329	3.1990
TAN17	0.6706	9.3280	2.7590	2.1840	22.7302	0.5650
	144.3710	378.3445	558.7009	5.8552	29.7808	174.9522
	7.8092	39.0197	76.4017	5.2947	1.2824	4.0150
	2.5850	0.4222	4.3813	1.0350	13.5031	2.5050
TAN18	0.6677	8.1490	2.6100	6.6120	23.4807	0.4802
	137.0250	693.0129	790.2229	6.1194	38.6255	133.9296
	6.0948	32.2129	67.9150	4.6025	1.1780	4.2310
	1.8200	0.3402	3.8480	1.0661	11.5681	2.9130
TAN19	0.6579	7.0930	2.0940	5.0690	23.3488	0.4552
	121.7160	682.4031	900.6121	6.3682	49.2940	103.7631
	5.1678	25.7588	53.3294	4.4085	1.1219	3.7950
	1.8254	0.3102	3.2270	0.8807	8.5304	2.5360
TAN20	0.6912	8.9940	2.5730	5.0990	22.6273	0.5753
	142.8000	549.4844	825.1960	5.8051	35.0118	145.6702
	7.4426	31.0323	64.8301	4.4528	1.1387	4.2420
	1.8267	0.3716	3.5550	1.5821	11.8932	1.8369
TAN21	0.6063	8.8300	2.7540	3.7600	23.4829	0.5040
	138.1070	544.1348	799.7881	6.0596	34.9446	149.0520
	7.9989	35.3500	68.1249	6.2674	1.1146	4.1690
	2.5614	0.4192	4.3013	1.0364	12.0723	2.7820
TAN22	0.5854	8.9950	2.8670	3.6170	22.2961	0.5040
	141.3490	509.1377	775.3831	5.7756	33.1395	141.7458
	7.0831	32.3437	67.8330	4.6332	1.0846	4.5670
	1.9968	0.3688	3.7793	1.8370	11.9452	1.8765
TAN23	0.5911	8.6700	2.6440	3.5830	22.5127	0.5049
	146.7400	523.2278	791.3721	5.7661	33.3733	139.7956
	8.0676	33.0368	67.2134	5.1848	1.0771	4.3900
	2.3517	0.3988	3.6606	0.7919	11.3231	1.9100
TAN24	0.9164	10.4580	2.7520	2.2910	23.8009	0.4714
	113.4000	180.3288	886.8770	5.7799	22.7238	192.8277
	10.7031	36.8706	75.3916	6.3135	1.3978	4.7720
	2.9922	0.3873	4.4465	1.3037	15.1229	1.8793
TAN25	0.9645	10.4000	3.0310	2.3710	24.2753	0.4691
	115.2080	186.3422	877.9951	5.9402	24.5590	159.2149
	10.5451	38.0089	80.1849	6.0093	1.3415	5.6480
	2.7910	0.3813	3.6101	1.3891	15.9472	2.1420
TAN26	1.0462	10.7350	2.7250	2.2100	25.3913	0.4715
	116.7850	187.0693	907.5559	6.1848	24.0171	186.3652
	10.7059	41.0261	77.0054	6.9891	1.4853	5.5230
	3.2793	0.4784	4.4915	1.4869	15.4678	2.6530
TAN27	0.9725	10.7852	3.8591	2.3358	25.3411	0.5150
	109.2795	196.3340	951.3569	6.0377	24.6922	176.5792
	10.7350	38.7950	86.9037	6.5138	1.4108	5.2318
	2.8322	0.4187	4.7899	0.0000	16.0871	4.8767
TAN28	0.5669	8.7040	1.2630	5.3760	23.2244	0.4745
	127.3310	456.4192	866.4709	6.2225	33.7993	119.0609
	7.4389	32.5572	64.9892	4.7602	1.2010	3.9160
	1.8822	0.3957	3.8337	1.8822	12.8274	2.7433
TAN29	0.5560	8.0750	1.5740	4.6520	23.4250	0.4394
	123.7580	413.3860	806.0630	6.2852	31.3657	129.0218
	6.6443	33.5106	66.2456	6.3745	1.4051	5.2500
	3.2140	0.4480	4.6931	1.1401	12.6524	2.4190

TAN30	0.5540	9.6392	2.5629	5.8458	17.5431	0.5148
	136.8394	328.1182	925.8477	4.5946	26.1091	84.5150
	5.0984	31.0549	49.9263	5.1013	1.2244	4.1984
	2.8522	0.4150	3.3583	0.0000	8.8094	4.5018
TAN31	0.5337	9.1963	2.6033	5.4425	30.5193	0.4180
	135.8503	584.8171	907.7097	8.0193	43.3118	149.3291
	8.7391	30.8458	83.4932	5.0390	1.5756	4.3024
	2.6587	0.3623	5.2246	0.0000	16.2264	4.2917
TAN32	0.7512	9.1980	2.4480	3.1490	25.2294	0.5064
	139.9340	362.8782	813.6111	6.3269	32.1867	148.0695
	8.6023	38.4851	75.4358	5.9294	1.5275	4.6380
	2.6023	0.4550	3.4229	1.2947	13.9651	2.2278
TAN33	0.6757	9.4620	2.5190	3.4050	22.5913	0.5353
	134.8300	312.5156	808.9861	5.7218	29.1982	168.5250
	8.0094	36.0270	67.5634	7.0617	1.2052	4.3380
	2.6997	0.3848	4.1408	0.8935	12.4975	3.5860
TAN34	0.6543	9.6740	3.0170	3.3990	25.1231	0.4872
	152.3970	334.8103	809.0769	6.1278	31.8244	177.8727
	9.8672	36.8760	80.7907	6.6347	1.2147	5.2460
	3.0680	0.4542	3.6348	0.0000	13.4550	2.9120
TAN35	0.6347	9.7900	3.2140	3.2310	21.6674	0.4786
	149.5740	313.2583	805.8521	5.5095	28.6479	155.2741
	7.8138	32.2647	66.5316	5.5790	1.2472	4.1330
	2.6489	0.3312	3.2207	0.9687	12.1317	3.5580
TAN36	0.6288	7.6420	2.3080	6.0810	21.1923	0.4933
	122.7600	626.0925	784.5281	5.6143	37.0991	133.5296
	6.4089	29.1835	62.1064	4.4503	1.0746	4.0700
	2.5278	0.3557	3.0277	1.4384	11.0903	2.1704
TAN37	0.6107	8.0140	2.7030	6.5110	20.2678	0.3833
	123.8260	593.7119	783.7590	5.3481	35.2787	127.2404
	5.7370	29.7816	57.8926	4.7276	1.0800	3.8670
	2.4151	0.3644	3.6178	0.9168	9.7911	3.5840
TAN38	0.5944	8.0540	2.2600	6.4700	21.1750	0.4577
	130.1540	600.6838	764.7141	5.4473	35.4903	127.4608
	6.2377	29.1460	55.6695	4.7610	1.2595	2.8190
	2.2782	0.4229	3.5353	0.0000	10.2054	3.3580
TAN39	0.7242	8.1540	2.6540	6.5280	21.9896	0.5171
	131.4060	625.1565	878.6001	5.7181	38.5996	127.9047
	6.1099	30.0209	63.9889	4.5418	1.1200	3.4770
	2.9134	0.2928	3.4060	1.1918	10.5260	3.7790

Museum of Classical Archaeology, Cambridge.

Argive Geometric sherds from Asine.

AS20	0.9156	7.2302	1.7086	10.1536	16.9203	0.4267
	78.6679	187.2388	905.9368	4.3263	21.5338	90.1937
	4.6152	27.4735	56.8051	5.2297	1.1754	3.3450
	2.1769	0.3070	4.4772	0.7345	9.3734	3.7000
AS21	0.9437	7.6696	1.8498	8.9745	18.3037	0.4766
	87.3265	189.3980	1028.2959	4.7658	23.9263	98.6801
	4.5489	30.3920	61.1116	5.6544	1.2865	4.3269
	2.8151	0.3929	4.6919	0.9749	10.4434	3.7060
AS22	0.9473	7.5680	1.7766	8.4781	18.2238	0.4343
	100.0664	202.8432	965.6833	4.7118	23.7674	104.5053
	5.6656	31.5821	62.7463	6.3183	1.5470	3.9305
	3.0248	0.3768	4.4649	1.2247	11.1013	3.1607
AS23	0.8734	8.3410	1.7733	8.8089	19.8533	0.5394
	93.4980	208.4357	1130.6440	5.2199	25.5671	98.0240
	6.3904	30.9049	66.0353	6.0545	1.7334	3.9800
	2.2315	0.4516	4.3711	1.1098	11.7154	3.8163
AS24	1.0548	7.0275	1.6470	9.5257	16.9363	0.4240
	89.5552	183.4629	864.6235	4.3186	21.4128	77.7739
	4.7658	27.7084	55.9925	5.2563	1.4530	4.1509
	2.3563	0.2621	4.2624	1.0369	9.4044	3.5265
AS25	0.9637	7.7344	1.7443	8.1275	18.4073	0.4445
	101.2055	204.0150	945.8767	4.7675	22.2667	96.6964
	5.3995	30.5334	64.1564	5.9217	1.4743	4.4439
	2.6778	0.3583	4.2838	1.3075	10.7443	3.5414
AS25B	1.0434	7.6902	1.9986	8.5279	19.1578	0.5218
	123.6433	222.7438	925.3745	4.7765	22.4541	81.9746
	5.2768	32.5211	64.5331	5.9917	1.4733	4.5851
	3.2757	0.4299	4.6982	0.8481	10.7662	2.6858
AS25C	0.9517	7.2188	2.0773	7.9259	17.8365	0.4537
	112.7132	201.1554	925.4072	4.5997	20.1618	89.5598
	5.2845	28.8165	55.9243	5.2564	1.3779	4.3482
	2.6273	0.3431	3.8969	1.0142	9.9947	3.1154

Argive Geometric sherds from Argos.

AR03	0.9035	7.6467	1.7789	8.4083	18.6778	0.4619
	95.5937	194.5999	1071.5859	4.8101	22.8641	99.1557
	6.2525	30.8745	62.7016	5.9935	1.6736	4.1386
	2.3183	0.3933	4.2765	0.8885	11.2995	4.4098
AR04	1.0531	8.4441	2.2978	8.5307	21.6404	0.5184
	115.4880	237.3480	1057.0310	5.6881	26.6522	133.1715
	6.4560	33.9563	74.4182	6.5777	1.6582	4.5609
	2.4956	0.4968	4.7253	0.8354	12.6797	3.5827
AR05	0.5999	7.0810	2.1640	10.7043	21.0908	0.4192
	102.5704	233.3401	1054.3611	5.5396	29.1861	126.8568
	9.2826	31.8693	62.9372	5.6118	1.3838	4.1485
	2.6376	0.3477	4.0848	0.7388	11.3445	3.6175

Argive Geometric sherds from the Argive Heraeum.

AH01	1.1573	7.6092	1.3982	9.9143	17.8737	0.4169
	98.2827	219.5559	1016.0730	4.6318	23.8472	99.0053
	4.7270	29.4429	60.7567	5.5423	1.1214	4.0173
	3.0964	0.3175	4.2712	0.9206	9.8706	3.4928
AH02	1.1821	8.2305	1.7644	9.3131	19.5255	0.4789
	110.0972	241.9359	1128.9619	5.2300	26.1718	100.3290
	5.7696	30.8529	66.4519	6.2632	1.5181	4.5458
	2.5401	0.3911	4.4398	1.0290	10.7158	3.8085

Late Corinthian sherds from Corinth.

CO18	0.3731	8.2392	2.3135	9.6607	25.4486	0.5085
	146.3213	270.8538	952.2578	6.4771	33.2436	175.5413
	10.9442	34.6610	72.3971	6.3065	1.5390	4.6724
	2.5447	0.5284	3.3846	0.8725	11.6513	4.7899
CO41	0.5570	8.0050	2.5712	7.1655	24.8070	0.4933
	130.3227	252.3911	1017.2971	6.3518	29.1116	176.8202
	10.1197	36.0662	68.0812	4.6406	1.1564	4.7623
	3.0282	0.4136	3.6695	0.8390	12.5530	3.3842
CO43	0.4041	8.0500	2.4467	11.4672	25.2624	0.4533
	151.7491	276.5146	921.4944	6.2573	34.2797	164.8641
	9.7086	36.0135	66.8313	5.0658	1.3460	4.7138
	2.8322	0.4672	3.4578	0.9538	12.1845	3.4800
CO43B	0.4137	8.8657	2.8410	10.8121	25.2504	0.5082
	158.7691	277.1338	876.5845	6.2635	35.0462	147.8609
	11.4587	35.5419	64.6647	5.8367	1.4673	4.6138
	2.9717	0.4315	3.3210	1.1928	12.5350	3.7656
CO43C	0.4205	8.8337	2.6065	10.8449	24.0735	0.4793
	164.3996	259.0659	877.6277	5.9967	32.0728	148.7100
	9.9126	35.3529	63.9345	5.6500	1.4572	4.1334
	3.7283	0.4562	2.6533	0.4813	11.5832	4.4625
CO46	1.2513	7.3888	0.9227	12.5473	24.5515	0.4766
	133.4514	279.5352	973.8628	6.1964	35.2171	73.9240
	9.0120	30.4419	48.6856	5.4643	1.8079	4.0977
	2.6491	0.2734	3.2525	1.0329	11.0955	3.4327
CO59	0.5884	6.9899	2.3329	11.7985	23.2691	0.4417
	112.4034	268.6716	1011.6030	6.0146	32.2709	152.5945
	8.9979	35.0124	61.2951	5.7363	1.4630	4.5615
	2.1427	0.3624	3.7285	0.8942	11.4847	3.4511
CO66	0.3698	7.0842	2.0371	10.0891	26.7275	0.4348
	135.8749	313.9023	927.2207	6.9224	34.0753	145.7351
	9.7423	37.4368	70.4647	6.9726	1.4816	5.0511
	2.9736	0.4224	3.8207	1.1666	13.1974	3.6113
CO86	0.4176	7.0639	1.8015	11.9816	23.5005	0.4212
	101.6967	246.3876	1157.9150	6.1180	32.1688	134.9537
	9.0632	34.8487	63.0398	6.4910	1.6073	3.8713
	2.5725	0.4603	4.4712	0.8360	12.2896	3.3679
CO90	1.1311	6.8985	1.8431	9.8295	23.1268	0.4284
	104.7546	278.3972	800.3640	5.9596	32.9612	123.4552
	8.9046	31.9725	63.1976	5.5819	1.2753	4.2505
	2.5322	0.4034	3.7546	0.9015	11.1256	3.3146
CO93	0.4343	9.4924	2.1729	8.7508	25.0802	0.5042
	151.9811	278.6050	789.3833	6.0929	34.5987	157.6950
	9.9599	33.2644	62.0542	5.3459	1.1973	3.9554
	3.6033	0.4726	3.5408	0.9738	11.8987	2.8891
CO96	0.5866	8.4127	1.8764	12.3233	22.5466	0.4907
	120.3555	283.8816	1090.9551	5.7615	32.4557	152.3836
	9.5001	31.8659	57.5054	6.2060	1.2405	4.7571
	2.4189	0.3474	3.3549	1.1392	11.2058	3.6052
CO100	0.5858	8.0642	1.2813	9.8301	20.4950	0.4437
	128.2824	259.1880	1061.6030	5.6568	27.6645	149.8291
	10.3765	31.3936	62.1507	6.6356	1.3053	4.3262
	2.7374	0.4171	3.2347	0.9886	11.8182	3.5697
CO102	0.5658	7.6751	2.2147	10.4960	23.2598	0.4957
	127.1180	238.0154	1015.3020	5.8976	34.2007	148.0377
	9.3105	36.6702	64.1810	6.7594	1.4808	4.0027
	3.1758	0.4864	3.6579	0.7963	11.9388	4.1892

CO107	1.1348	7.8237	1.3449	9.8778	22.6573	0.4783
	140.9835	264.5017	881.7314	5.5963	31.8004	102.3889
	9.1500	31.5317	56.9894	1.8872	1.2188	4.3269
	2.6571	0.3435	3.2469	0.8742	10.7123	3.7357
CO109	0.6269	7.4862	2.3322	10.0480	21.7237	0.4595
	119.1281	245.0921	897.6750	5.4847	31.2775	144.8012
	8.6385	31.7384	57.6999	5.0423	1.2357	4.6577
	2.4435	0.3609	3.4065	0.9396	11.3064	2.9156
CO111	0.6274	7.5806	1.9199	8.2841	22.6471	0.4739
	119.7269	262.6262	784.0859	6.1500	33.4228	129.0988
	8.2669	33.5628	61.5625	6.8874	1.3328	4.7175
	3.1291	0.4496	3.6030	1.3327	12.7121	3.2528
CO112	0.5652	6.5312	2.4684	8.7769	20.2142	0.4089
	111.7271	234.8536	823.3677	5.5157	30.9911	125.7676
	7.3390	31.7508	57.4635	5.1418	1.1978	4.8314
	2.8867	0.3764	3.5076	0.9667	10.4744	3.8872
CO136	0.4381	8.5982	2.1123	11.3604	22.1618	0.4824
	148.3542	242.3860	1024.3391	5.5206	29.5948	150.9574
	8.8234	34.1768	62.5213	4.8621	1.2100	4.6031
	2.6052	0.3682	2.7637	1.0102	10.4863	3.4379
CO139	0.3764	8.5192	2.3523	7.3616	27.0770	0.4937
	140.0870	313.6492	840.9065	6.7680	39.8774	182.9111
	9.9370	37.2219	64.6746	6.7099	1.3312	4.3319
	2.9572	0.3648	3.6734	0.6659	12.7366	3.0766
CO140	0.8141	8.6926	2.4479	9.8412	22.6474	0.5307
	133.0472	234.8505	855.6582	5.7974	28.3032	121.3368
	10.3898	35.4567	65.9967	6.7037	1.4562	5.2416
	3.2173	0.4391	3.6934	0.9554	12.3922	3.2486
CO142	0.5127	8.7870	1.7824	9.3654	22.9866	0.5874
	132.0214	237.9941	1034.9089	6.0091	28.7687	152.3027
	9.9612	34.6160	64.8997	6.4005	1.5917	4.7322
	2.0992	0.4156	3.4773	0.7206	12.0017	3.2829

Geometric and Black Glaze sherds from Mycenae.

MY3A	0.9000	7.4182	2.4216	9.9959	17.7798	0.3798
	100.0732	184.7071	878.8296	4.7194	21.5039	89.8750
	5.6830	26.5625	59.5004	5.5417	1.0432	4.2632
	2.3805	0.4248	4.5540	1.3258	10.1913	3.3077
MY3B	0.9849	7.5021	2.0836	9.4647	17.7925	0.3500
	96.2888	185.2262	902.4836	4.6310	22.3462	99.1872
	4.6982	29.6051	60.1563	5.8741	1.3633	4.6651
	2.2357	0.4009	4.5402	0.6965	10.7757	3.7004
MY3C	0.9457	7.1177	2.7176	9.3832	16.4953	0.3882
	92.6222	176.1900	919.3652	4.2456	20.7139	84.5915
	4.8684	28.7851	57.9523	5.6720	1.2733	5.2522
	2.1940	0.3542	3.8402	0.6138	9.7094	3.4290
MY04	0.9513	7.8302	2.7321	9.7214	18.5118	0.4369
	105.1272	199.4129	862.4678	4.8997	22.4290	100.2921
	5.5475	27.4392	58.6232	5.5253	1.3896	4.0575
	2.3370	0.3702	4.6963	1.5723	10.7491	3.2800
MY05	0.8235	7.6958	1.6442	10.9684	18.4314	0.4113
	91.1250	195.7096	903.9263	4.8117	24.0338	97.8707
	6.0880	26.7315	59.1824	5.3215	1.2937	4.5185
	1.1643	0.2133	4.8091	1.1755	10.1943	3.5964
MY07	0.4867	9.2573	2.4685	10.2976	22.4898	0.4527
	125.3771	262.0525	1052.7241	5.7782	30.1288	143.7761
	9.9518	31.6982	66.5025	5.4685	1.2310	4.2594
	1.9165	0.3746	4.0042	1.5293	12.1223	4.2012

MY08	0.8945	8.4434	1.9836	8.7972	19.2666	0.3987
	105.5511	220.8568	979.8125	5.0186	23.9335	86.9626
	5.0135	28.8728	62.9389	5.5692	1.3810	4.5283
	2.4213	0.3877	4.8863	1.3101	11.0447	3.7586
MY09	0.5056	9.4557	3.1721	8.5379	25.1721	0.5033
	157.3564	272.4600	785.0347	5.6255	29.2181	158.5542
	32.4956	36.3875	73.0943	5.9380	1.5034	4.9685
	1.4698	0.4362	3.3866	1.0961	12.2734	3.7873
MY10	0.3303	7.0449	1.6640	14.3630	18.6309	0.3782
	98.1981	209.8607	908.9443	4.4300	22.9791	98.4415
	7.5401	28.0718	57.0336	4.6196	1.1732	4.1233
	1.5634	0.4370	2.7060	0.4969	8.7950	3.7265
MY11	0.9478	7.5310	1.7257	9.4067	19.1501	0.4984
	89.1407	190.1460	936.6497	4.8490	22.5683	88.7415
	6.1805	30.5267	62.4319	5.5814	1.2636	4.7350
	2.3155	0.4463	4.9771	0.8359	11.1170	3.5391
MY12	1.0562	8.1886	1.3700	7.7664	21.4982	0.4943
	126.8962	263.9673	864.2053	5.8298	27.0859	94.0931
	10.5515	28.7098	65.9985	5.2638	1.6993	4.0145
	2.7445	0.4654	3.1402	1.0270	10.7484	3.6949
MY13	1.0126	7.8400	1.7232	9.0158	20.8292	0.4783
	98.0943	238.9895	972.6772	5.5361	23.9125	90.0750
	6.4414	33.3426	69.2333	5.8369	1.6761	4.9181
	2.8558	0.3340	4.6181	0.7685	11.5899	3.3984
MY14	0.3319	9.7201	3.0500	7.1024	26.8613	0.4661
	170.2468	275.6970	925.9138	6.0242	34.5776	200.8859
	10.9164	37.2554	66.1750	5.9517	1.3529	4.3748
	3.0236	0.4780	2.7417	1.6001	13.6081	3.2147
MY14B	0.3493	10.1100	3.2474	7.4371	25.8347	0.4570
	181.5856	263.0991	952.7051	5.7737	34.8994	168.8369
	10.3943	36.4152	62.5385	5.3688	1.3854	4.0522
	2.3305	0.4038	3.5085	0.6724	11.6327	3.7248
MY15	1.0594	8.1017	1.3009	10.6006	21.9031	0.4771
	107.9704	245.4337	969.3774	5.8686	29.2581	104.9787
	9.3368	30.5461	60.0416	5.0891	1.1359	3.4120
	2.5892	0.3350	3.5929	1.2836	11.6710	3.5546
MY16	1.0567	7.4782	2.1070	6.4230	20.9529	0.5213
	102.8728	217.4115	882.5383	5.1755	23.9513	119.5313
	6.1578	30.7350	51.0541	5.7660	1.6957	4.4233
	3.0712	0.3589	5.2508	1.4979	12.0247	2.7905
MY17	0.7844	7.4921	1.9786	7.9606	20.9625	0.4210
	102.1843	227.7331	1051.4441	5.3924	25.8507	110.5163
	5.4509	31.4763	66.8989	5.8621	1.4602	4.4063
	2.8647	0.3491	4.3911	0.2416	11.1993	3.7285
MY18	0.5898	8.2581	2.4637	8.4175	23.8683	0.5156
	137.6361	250.8613	851.8281	6.1700	29.1732	166.1860
	10.6146	35.3487	74.0938	5.4636	1.1491	4.2987
	2.3098	0.3270	4.1430	1.0651	12.4528	3.5875
MY30	0.6281	8.7338	2.4094	7.1430	21.7921	0.4922
	115.5018	305.7761	1893.0090	5.9467	38.0509	121.9732
	9.3820	46.6142	90.9969	7.9399	1.7892	6.6542
	4.4644	0.3939	5.4270	0.7303	13.7183	5.4461
MY32	0.4683	8.7201	2.4979	10.8969	22.2478	0.4405
	133.3149	244.7286	990.2527	5.5884	28.5214	140.9024
	10.3034	34.4254	65.4625	5.9771	1.6798	4.7104
	1.9313	0.4089	3.2405	0.7564	11.7665	3.3578
MY33	0.7827	8.2567	2.0208	5.7532	20.1841	0.4795
	103.4984	283.6211	1283.8689	5.3375	31.4699	115.7132
	7.2751	43.2342	83.3837	7.3059	1.7010	5.1739
	2.8777	0.5447	5.7564	1.0628	12.7808	4.0397

MY34	0.4131	9.5097	1.8458	5.5474	20.6224	0.6010
	128.9884	180.9843	1475.7549	5.6894	26.8364	121.2411
	7.2447	52.9919	98.8932	8.3428	1.7601	6.3018
	2.3870	0.5017	6.6402	1.2538	15.7201	4.7289
MY35	0.6833	8.4765	2.5208	5.4458	19.6023	0.4872
	96.1096	261.1062	1315.8899	5.0602	29.5026	124.8114
	6.9178	39.7436	72.6636	6.6273	1.3833	6.0342
	3.9733	0.4816	5.0911	1.2526	12.4466	4.6527
MY36	0.7022	7.8800	2.7888	6.0065	19.5847	0.4698
	100.1249	280.8718	1406.7400	5.1416	32.5973	122.8186
	7.6424	41.2276	78.8394	6.9682	1.5583	5.6505
	2.7477	0.3921	4.9093	1.0623	12.4466	3.3565
MY37	0.7563	8.8762	2.7827	3.6492	24.4086	0.4662
	136.7759	387.0164	1510.5540	6.5126	39.4830	151.8467
	9.4637	41.9938	85.0193	6.8770	1.5562	5.1097
	4.0875	0.5043	4.9441	1.2626	15.3813	3.9450
MY38	0.6422	9.1809	2.6805	4.1447	23.4412	0.5169
	120.4168	358.0208	1725.2871	6.2675	39.3847	127.5821
	8.0300	44.3647	81.9648	7.6172	1.5831	6.3481
	2.7031	0.3852	4.8764	0.9839	13.4754	4.6866
MY39	0.5914	9.0555	2.6863	5.0779	21.5873	0.5462
	131.1279	269.0012	1170.7749	5.4666	31.3736	138.8674
	8.8260	43.8680	76.1320	7.5472	1.4857	5.2863
	3.1663	0.3754	4.7566	0.5024	14.5202	4.6260
MY40	0.9928	7.5021	2.0005	9.6754	20.4878	0.5293
	109.2479	228.5643	1074.7891	5.1636	24.6014	112.5726
	6.7892	34.7921	74.4241	6.1423	1.4991	4.1230
	2.7756	0.5499	5.4318	0.5846	10.7967	3.7370
MY41	0.7124	7.9208	2.7489	4.8500	19.0953	0.4618
	111.3512	267.5884	1327.4619	4.9671	31.2383	111.7425
	7.6403	39.4007	72.0060	6.4419	1.5774	5.6301
	4.1172	0.4102	5.1958	1.1026	13.2783	3.5540
MY42	0.7634	8.5743	3.1679	4.3965	22.5039	0.5600
	107.2164	299.8662	1195.8091	5.7654	32.5720	139.4879
	8.6075	45.3147	88.3632	6.6160	1.6245	5.7352
	3.2133	0.4049	5.3370	1.4312	14.4519	3.7520
MY43	0.6800	8.4528	2.8775	4.1932	21.0344	0.4937
	90.6024	293.3599	1133.6560	5.4816	31.3768	130.3191
	7.6200	41.8602	91.7433	6.7237	1.8232	4.9628
	2.6476	0.4289	5.1380	1.8146	14.5353	3.0732
MY45	0.5810	8.8844	2.7687	6.7234	24.6626	0.5263
	121.4025	325.7961	1491.7361	6.3448	37.3121	137.4949
	9.1953	45.7156	88.7421	7.6817	1.8445	5.8993
	4.1479	0.4730	4.6220	1.1183	14.0408	4.8295

Protocorinthian sherds from Perachora.

PC01	0.8745	9.1337	3.4436	9.3857	22.4990	0.4647
	166.6746	250.7380	851.1665	6.0117	31.3789	134.0209
	8.5509	33.3174	69.4689	5.6304	1.2811	4.8933
	3.0577	0.3163	3.4129	1.1671	11.4401	3.7530
PC03	0.7878	10.0889	3.1342	22.7120	25.8692	0.5738
	154.3772	328.5735	1402.7300	6.9804	32.6424	141.8806
	13.5941	31.6054	61.9148	5.8408	1.8244	5.7795
	2.3307	0.3045	3.4133	1.3580	13.1119	4.7332
PC07	0.5966	8.6559	2.8576	11.7193	24.4308	0.4799
	159.2258	288.9729	975.3323	6.4461	32.4300	150.3596
	13.2941	34.7158	60.6680	5.9667	1.6609	4.3803
	2.9740	0.4720	4.5287	1.0491	11.3724	3.6712

PC10	0.7264	8.3127	3.0257	10.1222	24.8756	0.5506
	143.2131	316.2410	899.1572	6.5602	33.7215	151.4500
	11.3710	36.0528	79.0335	6.0973	1.1852	3.8709
	3.6140	0.2593	3.9957	0.7279	12.6799	3.6080
PC13	1.3214	7.6795	1.6224	10.4922	25.9817	0.4431
	133.9935	287.5613	853.9460	6.6055	32.4530	86.2592
	13.0160	27.4656	55.8687	4.7207	0.9929	3.4128
	0.6209	0.4988	3.6574	0.9801	12.2293	3.4879
PC15	0.5431	7.8078	3.3007	9.7640	23.6490	0.5075
	142.1803	281.0996	942.0244	6.1412	31.6209	147.8186
	9.3885	33.1489	61.7766	5.4649	1.3710	3.7431
	3.9383	0.5059	4.6816	0.4318	11.7840	3.4440
PC15B	0.5287	8.4469	3.3698	10.1623	21.3519	0.4612
	157.4185	239.0178	952.6372	5.5026	29.3543	128.7852
	8.7066	32.2303	60.6028	5.1656	1.2476	4.1607
	2.1841	0.4157	3.1712	0.8926	10.5487	3.9106
PC16	0.7691	7.6444	2.1830	7.1455	21.0013	0.4875
	101.3750	262.5664	822.5029	5.7400	28.0971	123.7153
	8.1713	32.7180	64.0835	6.0819	1.1971	4.3775
	3.1730	0.3815	4.6230	1.5053	11.8680	3.1969
PC20	0.4759	8.8063	3.5070	9.4929	24.2002	0.4784
	140.2227	262.2588	784.4905	6.0665	31.9315	158.3305
	10.6478	34.2326	65.5865	5.7497	1.2555	4.3646
	1.9833	0.4545	3.2752	1.0741	12.1260	3.1259
PC22	0.7018	8.3207	2.3861	11.0277	22.3327	0.4305
	126.8509	266.8750	929.8457	5.9712	31.1258	147.2365
	10.0098	34.7587	65.0979	5.8797	1.2208	4.6716
	2.7622	0.4434	4.0698	1.1930	11.3770	3.8432
PC24	0.5559	9.1258	2.9786	10.3470	25.5484	0.4544
	140.3160	275.4507	869.4116	6.5746	33.5686	154.1094
	11.5181	35.9674	64.3436	5.9090	1.0589	4.4452
	2.2752	0.5067	4.2098	1.0246	12.8004	3.7197
PC27	0.8167	8.5621	2.0927	10.5006	22.2199	0.5036
	103.3859	259.9324	911.9478	6.1450	29.1148	141.4566
	9.3681	34.0798	70.8711	6.1150	1.5236	4.4073
	2.5652	0.3905	4.2611	1.0757	12.5054	3.2474
PC34	0.6252	9.1123	3.2459	10.5388	24.7317	0.4528
	152.5238	273.0063	959.3127	6.2003	31.9216	152.9580
	10.2877	35.2911	73.4653	5.8339	1.5121	4.2881
	3.1010	0.3746	3.5256	1.1301	12.2474	3.4339
PC35	0.5349	8.2787	2.5277	11.5210	23.8510	0.5117
	117.4010	307.8811	887.3108	6.2052	32.5814	128.9356
	10.5844	34.6491	68.9631	6.3461	1.3232	4.1934
	2.1524	0.3293	3.7484	1.3675	13.0716	3.5406
PC40	1.4976	9.0804	0.5287	11.4988	25.1115	0.5096
	155.3093	275.4541	913.0786	6.4859	31.4825	33.2248
	11.0648	32.9757	60.9178	5.7831	1.3418	4.1065
	2.7600	0.5658	4.2299	0.9651	13.2198	4.2072
PC41	0.8818	9.3334	3.4175	10.6631	24.0486	0.5088
	144.3819	240.6601	837.0671	6.2076	29.8689	145.7985
	10.6448	35.2627	74.3305	6.2042	1.6412	3.8611
	1.6611	0.4756	3.8491	0.6043	12.4126	3.6482
PC42	0.8996	8.1333	1.8874	8.8612	20.8149	0.4061
	103.5431	261.6824	1008.1069	5.2581	26.9174	126.0902
	10.0036	30.1580	61.6050	5.8922	1.1211	3.9716
	2.1415	0.4141	3.8687	0.7452	11.3935	3.8721
PC45	1.0778	8.3391	2.1988	9.1519	22.6478	0.4947
	114.9488	265.9631	945.7051	5.8966	30.1877	131.3071
	9.3426	31.6667	67.6360	5.4047	1.0075	4.7052
	3.0274	0.1502	4.7543	0.9640	12.0070	3.9540

PC47	1.0917	7.4053	3.0595	10.2830	22.7439	0.4069
	129.7096	267.9912	927.7456	5.9319	31.1920	144.1338
	10.7752	33.7823	69.9657	6.0034	1.7569	4.6586
	3.4127	0.5753	4.9279	0.9021	13.1571	4.1471
PC54	1.4107	9.1011	0.9323	11.7383	25.3337	0.4440
	138.5750	278.1047	903.4414	6.3032	33.5503	72.6949
	9.7445	29.9381	63.9229	5.1069	1.2561	3.6139
	2.2010	0.3619	3.9368	1.3507	12.6647	3.4235

Argive Geometric sherds from Tiryns.

TI01	0.9540	7.6425	1.7741	8.6070	19.0872	0.4577
	100.0018	206.3755	977.1982	4.8652	22.9371	100.1790
	5.0767	31.1205	64.0797	5.7313	1.3620	4.1642
	2.7537	0.3764	4.0586	1.0725	10.3224	3.4589
TI03	0.8688	7.3569	1.3365	12.7874	17.4895	0.3857
	94.5281	182.1519	921.2981	4.4499	21.1050	103.1882
	5.1273	28.6065	57.4536	5.6521	1.4016	4.2570
	1.7726	0.3478	4.0647	0.8393	10.1405	3.7893
TI3B	0.9034	6.9616	2.2462	8.6192	20.2710	0.4813
	96.4146	208.3783	993.3464	5.1778	21.9803	107.8349
	6.8304	29.7962	64.5278	6.0532	1.2881	4.9902
	2.6078	0.3279	4.4949	1.2677	12.0563	3.5297
TI3C	0.9318	7.2177	3.1203	8.7609	20.0145	0.4554
	93.0988	202.7107	1035.1050	5.0974	22.6724	122.6548
	6.0409	31.0775	62.5256	5.9989	1.8104	4.7952
	2.8566	0.5113	4.4063	1.3832	11.6583	3.7950
TI3D	0.9354	7.8509	2.0396	9.7705	20.9083	0.5005
	99.3752	217.2900	970.2493	5.2126	21.5841	116.7071
	5.8153	31.1626	65.6154	5.3504	1.2781	4.0987
	3.0955	0.3696	4.8288	1.0439	11.4436	4.8084
TI04	1.0022	8.2187	2.1242	8.0808	20.0017	0.4678
	97.2638	209.3077	972.5171	5.0323	23.4403	107.1202
	4.9722	31.9324	62.7593	5.8962	1.2101	4.2722
	2.6484	0.4108	4.2529	1.1076	10.7234	3.3969
TI11	0.8700	7.8209	2.4225	8.2800	18.7834	0.4822
	100.5188	207.8835	982.4990	4.7970	22.9080	108.4580
	5.6425	30.0961	64.7014	6.0981	1.3243	4.3560
	2.5865	0.3759	4.3184	0.6911	11.2198	3.7737

Samples collected at Nauplion.

Black Glaze sherds from Swedish Berbati excavations.

B02	0.6675	8.2346	2.5749	5.6260	19.6396	0.4838
	103.3748	279.3867	961.9404	5.2335	30.7272	133.7860
	7.3924	38.8624	77.0658	6.3246	1.3330	5.0970
	2.0887	0.4380	5.4502	1.0448	13.0885	3.7806
B03	0.6907	9.1212	1.8242	3.6115	20.9204	0.4638
	101.3097	308.4575	1393.0149	5.7083	34.1623	98.0714
	5.2910	41.7834	81.4061	7.1581	1.7238	6.1475
	3.5213	0.4415	5.3000	0.9562	13.7321	4.4321
B05	0.6089	8.8009	3.0770	4.5180	20.4950	0.4010
	114.1313	302.3625	1601.9939	5.4428	34.7680	118.3559
	7.4006	40.0654	77.1705	6.4772	1.5693	5.6686
	3.0859	0.4640	5.3805	1.1626	12.0444	5.1964
B06	0.7829	7.9672	2.0333	6.0227	15.0076	0.5815
	107.1974	125.9917	428.6826	4.2783	15.1521	101.7610
	7.2929	44.1761	82.8723	7.4371	1.7878	5.8986
	2.8610	0.5155	7.1431	1.8772	13.0831	3.1919
B07	0.5903	8.9714	2.5803	6.5394	21.0104	0.5093
	129.3549	289.0576	1932.3931	5.6886	38.8333	134.3520
	8.4148	43.5069	81.9286	7.3026	1.9233	5.9622
	3.8715	0.5252	4.5153	1.0562	12.7159	4.3750
B08	0.5966	9.7995	3.1585	5.2253	20.8480	0.5241
	133.0723	301.1907	1536.3110	5.5763	32.9657	138.0879
	8.2961	35.2892	69.5034	6.3146	1.4491	5.6088
	3.1959	0.4007	4.2682	1.0361	12.5292	4.7684
B09	0.7412	9.8168	3.3550	3.4772	23.1501	0.5585
	96.3357	306.1257	1568.5691	6.2112	38.7885	125.0355
	7.3158	43.4906	91.2267	7.4401	1.8131	6.3522
	3.5945	0.4844	5.5353	1.5656	14.9664	4.2567
B10	0.5177	8.5128	2.9089	8.0621	21.9587	0.4314
	101.3609	303.7229	1879.4519	5.7594	37.4219	133.3679
	7.5179	39.8627	78.2213	6.6209	1.4398	5.1995
	2.7669	0.4669	4.9939	1.1401	12.4933	4.6592
B11	1.0150	9.2646	1.6897	10.4967	22.9344	0.4831
	165.5475	244.7848	896.0669	5.7471	30.0618	145.5039
	13.2434	33.3541	68.3539	5.8074	1.7008	4.5125
	3.0819	0.5180	3.6961	1.2875	12.2489	3.5431
B12	0.3670	9.4203	2.0978	7.8624	25.8823	0.4412
	112.1214	340.0000	1039.2029	6.3437	40.9854	100.8139
	6.1434	30.6869	64.4104	4.9587	1.2718	3.5722
	2.7920	0.3477	2.8761	0.6157	11.7512	3.5141
B13	0.5258	10.9256	2.3379	4.4945	21.3638	0.6225
	141.9174	138.9941	1395.5249	5.7694	35.5779	121.6692
	6.6704	56.8280	121.0609	9.3127	1.8959	6.7169
	3.2987	0.5193	8.0706	1.5757	17.4840	4.5950
B14	0.5331	9.3091	2.2875	5.8712	22.6858	0.4390
	128.9164	304.7231	1592.6599	5.9887	36.9967	141.9679
	9.7156	41.8802	81.7499	7.1408	2.0076	5.3802
	3.4845	0.5196	4.8886	0.8822	13.1086	5.2139
B15	0.3320	9.9575	3.1011	10.0536	25.6398	0.5104
	158.6282	336.9602	1096.4141	6.1434	37.8487	111.7052
	7.2008	31.8126	60.7008	5.1114	1.5712	3.8847
	2.4315	0.3755	3.1556	0.6892	11.7407	3.9061

B16	0.6598	8.6479	2.6270	3.2992	19.9517	0.4356
	91.6551	274.8120	1122.6799	5.3033	30.2937	133.3713
	7.2191	37.1324	78.8664	6.0348	1.2657	4.9957
	2.7041	0.4643	5.8953	1.7991	12.6721	3.6347
B17	0.7997	8.7568	2.4021	3.7282	21.1812	0.5228
	107.8672	298.3269	1327.3320	5.5428	34.6743	145.6277
	7.7898	39.6749	82.0870	6.9261	1.3996	5.1795
	3.1681	0.4178	5.7595	0.9762	14.0389	3.8464
B17B	0.7805	9.3574	2.4126	4.1436	20.9618	0.4755
	111.9561	293.4170	1306.8860	5.6308	34.7233	129.6112
	7.5354	41.2375	82.7730	6.8218	1.2359	5.4378
	2.5447	0.4462	5.1963	1.4739	12.4696	5.3350
B17C	0.7900	8.7873	1.9521	4.6946	20.2502	0.5456
	116.4583	284.3911	1333.2190	5.3803	32.8815	130.3289
	7.2735	40.1007	78.8041	6.8046	1.2950	5.4245
	2.9991	0.4325	4.9711	1.0331	12.5142	4.3803
B18	0.6993	8.5600	3.3569	2.7796	18.3050	0.4927
	105.2688	252.8889	857.8005	4.8648	26.4001	133.4925
	6.9067	34.1589	70.9498	5.6168	1.2255	4.2020
	2.3101	0.4363	5.4468	1.1150	12.6649	2.7967
B19	0.5929	8.9614	2.6245	4.5839	20.6399	0.5245
	112.2881	281.8862	1363.2590	5.6104	32.6721	93.3662
	5.0946	40.9897	84.8776	6.3121	1.3471	5.1052
	3.2916	0.4864	5.7501	1.3675	13.9307	3.6545
B19B	0.6205	9.2767	1.9095	4.9119	20.8631	0.5674
	109.9095	294.5901	1351.7859	5.5794	33.0840	101.1277
	5.1899	42.7980	84.1140	6.6997	1.3769	4.9470
	2.5380	0.4758	5.9864	1.0891	13.5127	5.4576
B19C	0.6387	9.0974	1.7276	5.1836	19.8914	0.5513
	102.6106	279.6042	1342.5510	5.4620	32.2696	92.6104
	5.4227	41.8655	81.5202	6.7867	1.4531	5.6541
	3.1668	0.4396	5.6320	1.0486	13.1909	4.3633
B20	0.6946	9.0653	3.1813	4.7680	22.1069	0.5791
	119.8135	287.3862	1467.1531	5.9576	34.2975	121.7580
	6.9807	43.2343	86.6519	6.8484	1.4430	5.9853
	3.3133	0.5016	5.7361	1.0370	14.2944	4.4018
B21	0.5095	9.6346	2.5419	3.2621	24.8426	0.5421
	151.7510	305.0427	1527.8320	6.3783	38.1263	152.5317
	8.7764	44.3610	86.9174	7.5781	1.4192	5.6988
	3.4958	0.4702	4.6116	1.1415	15.2412	4.4807
B26	0.5748	8.6877	3.2162	3.9984	20.9560	0.4872
	120.9430	275.4270	1179.4709	5.5599	30.0113	129.1416
	7.8538	39.7452	81.4815	6.5885	1.4611	5.6369
	2.5918	0.4248	4.8878	1.2882	14.3478	4.0912
B27	0.9599	8.4114	3.0506	7.0604	21.7324	0.4428
	115.4117	224.4778	1178.4099	5.5608	25.4593	113.4701
	5.2633	33.3205	72.8490	5.9366	1.3606	4.8737
	3.2843	0.4688	4.6161	1.2219	11.5221	4.1523
B28	0.2722	7.9550	2.4696	7.5189	20.2618	0.3816
	116.3658	217.1620	1176.0359	4.8525	32.0738	137.2518
	15.5859	27.5149	58.5880	4.6480	0.9173	3.4929
	2.0017	0.3663	3.1045	0.6194	10.3480	3.4551
B29	0.6508	7.6923	2.2473	5.5970	17.0227	0.4306
	101.6055	277.7893	1124.0769	4.5236	26.4505	117.4391
	6.9608	31.3596	69.2254	5.4402	1.1368	4.2320
	2.0262	0.4164	5.0022	1.1631	11.4545	3.5454
B30	0.5685	6.2294	2.1163	10.4848	15.5423	0.3735
	85.9062	277.3496	972.5613	4.1108	24.7666	97.8636
	5.4555	29.9439	59.1428	4.7949	1.0132	3.7400
	2.0882	0.3214	4.4773	0.8398	9.5950	3.0812

B31	0.7961	8.3252	3.1218	1.8914	20.7550	0.5347
	104.4889	236.5482	574.0276	4.9903	25.4565	138.9576
	7.1781	38.8919	77.0249	6.5708	1.4876	4.7841
	3.0211	0.3199	5.7947	0.0000	13.8516	3.3410
B32	0.7007	8.4121	2.6155	5.0354	23.9810	0.4724
	101.9337	322.7529	1497.0659	6.5741	38.1760	122.6678
	6.0692	44.5933	97.0206	7.5522	1.7204	5.1891
	3.0310	0.5426	5.4707	0.0000	14.8408	5.9440
B33	0.4589	10.2421	3.3529	3.9561	22.3984	0.5632
	165.9566	299.2507	1654.7739	5.9972	34.3096	135.4389
	8.2103	45.6022	70.8861	7.2341	1.4452	5.5785
	3.9034	0.5441	3.6772	0.0000	12.2603	6.1073
B34	0.5811	9.4671	2.3666	3.1543	28.5870	0.5243
	139.6111	352.1775	1841.4041	7.4749	45.0464	175.0537
	10.0537	53.2246	102.1547	9.2468	1.8931	6.4874
	4.7760	0.7428	5.4225	0.0000	16.2216	7.1510
B35	0.6906	8.4948	3.1940	2.6721	22.7360	0.4773
	118.8611	306.3701	1013.1509	5.8082	32.4253	157.0693
	9.3980	42.2357	89.1253	6.8191	1.6894	5.1632
	3.2657	0.4650	5.2091	0.0000	14.3359	4.4710
B36	0.6391	8.0124	2.5021	4.4591	21.4918	0.4448
	115.0625	300.4763	1563.5110	5.6961	34.2264	126.7478
	7.2129	43.5181	84.3091	7.0647	1.6724	5.4517
	3.8091	0.4620	4.5849	0.0000	13.5587	5.9520
B37	0.3420	8.0779	2.4905	10.3419	25.6119	0.4637
	120.3742	301.6836	971.5293	6.4647	32.7292	131.9421
	10.1604	38.8080	74.2771	6.4511	1.4543	4.9387
	2.0923	0.3918	3.5974	0.0000	13.5074	4.3400
B38	0.6036	7.3512	2.5444	5.2970	21.1695	0.4688
	108.1759	323.7498	1610.2729	5.8876	36.6214	87.8256
	7.6320	42.8878	81.9603	7.2429	1.3990	5.2177
	2.9408	0.5945	5.6710	0.0000	14.8378	5.8780
B39	0.6839	8.4010	2.9903	3.3030	20.8030	0.4854
	108.9989	283.7925	1115.4360	5.3460	28.8550	168.4573
	7.1829	40.3520	79.1301	6.9184	1.4089	5.5151
	2.8662	0.4059	3.9899	0.0000	13.3562	4.8570
B40	0.6709	8.2914	2.5789	5.4469	21.2085	0.4667
	123.9840	293.3503	1405.5710	5.3584	33.9205	151.3450
	7.9161	43.2679	80.4794	7.7298	1.4773	5.1517
	3.5299	0.2803	4.9327	0.0000	13.6981	5.3440
B41	0.6433	8.4275	2.3173	6.9412	26.0469	0.4749
	131.4582	297.8462	1153.4741	6.2654	34.3734	127.1055
	10.4110	36.3273	65.1098	6.8877	1.9722	4.7257
	3.3597	0.4148	4.4457	0.0000	13.6996	5.0340
B42	0.2148	10.0187	2.1988	6.5829	26.8847	0.5556
	136.2820	426.0076	1260.1150	6.4741	31.3552	153.7352
	32.0605	40.8185	81.3823	7.3027	1.6353	6.6321
	4.7919	0.5672	6.0358	0.0000	12.4821	4.9800
B42B	0.2324	9.7946	1.8783	6.6952	28.3228	0.5799
	140.3397	420.0281	1225.9351	6.8448	33.7855	125.4662
	34.4897	43.2801	78.9728	7.7540	1.5109	6.0626
	3.6716	0.6724	5.8542	1.5227	12.4050	4.9566
B42C	0.2135	10.3147	1.5962	6.8514	19.8422	0.6162
	133.8763	208.5257	1219.4380	5.2938	24.0821	100.8986
	6.1310	40.2872	63.6471	7.2516	1.3217	6.5174
	3.5657	0.5180	4.7066	1.2500	11.7909	4.0201
BA01	1.1896	7.8156	2.0927	8.1671	20.1939	0.4341
	87.7250	218.4589	1010.2100	5.2518	25.1397	109.6873
	6.0232	31.5128	67.1678	5.7040	1.2608	4.6331
	2.3572	0.3840	5.1688	1.1845	11.3892	3.6639

BA1B	1.1398	8.8364	1.7999	8.8166	20.5409	0.5104
	87.0439	224.6883	1004.5129	5.3896	24.4646	111.9319
	6.3502	31.8565	65.0143	5.6006	1.2310	4.5450
	2.5046	0.3410	4.8711	1.0346	10.9302	4.8405
BA1C	1.0721	7.9748	2.5707	8.5399	23.1780	0.4702
	90.4580	349.8889	961.0630	5.5791	27.2043	97.4227
	28.7039	30.0519	65.4619	5.5226	1.2935	4.3873
	2.7416	0.3722	4.2071	1.0363	9.8763	4.7528
BA02	0.5026	8.0150	2.2790	7.8379	21.0265	0.4900
	127.5041	238.6018	945.9780	5.5873	26.3248	143.3083
	8.4668	29.3569	54.9950	5.0319	1.8780	3.8133
	2.4890	0.4179	3.9209	1.3486	11.1999	3.5249
BA03	0.4783	6.9543	2.3263	16.7527	20.6327	0.3650
	112.7677	245.3320	1001.9871	4.9909	30.5071	133.1725
	19.6891	30.9329	55.2096	5.0876	1.7229	4.2362
	1.9571	0.3558	3.1368	0.6528	10.1235	3.2904
BA04	1.0375	8.2908	1.4024	11.4065	23.6901	0.3445
	134.4043	311.2410	912.5632	5.4459	36.7066	149.4869
	10.6565	32.1267	61.6108	5.1515	1.6450	4.4332
	2.5857	0.3782	3.4176	0.8730	10.4866	3.6707
BA06	1.1115	9.0115	0.8269	12.5440	24.2878	0.4970
	108.2509	264.1267	1023.8491	6.0194	34.2690	60.0140
	7.4874	33.6861	64.6514	5.3868	1.2851	3.8150
	3.1335	0.3231	3.2486	0.8783	11.0827	3.2109
BA6B	1.0486	8.6170	1.0381	12.5572	20.0555	0.4845
	104.0366	226.9636	993.1367	5.2385	24.0302	115.3958
	11.1725	34.0919	64.8025	5.5560	1.2604	4.4367
	1.8427	0.4126	3.2238	0.9867	10.8501	4.5344
BA07	0.7781	8.6147	2.3949	5.2623	19.3364	0.4435
	94.9275	280.9204	1579.3530	5.1808	34.8659	124.9585
	7.5898	40.2845	76.4168	7.0009	1.5663	4.6180
	2.9762	0.4360	5.2232	1.0539	12.0684	5.1152
BA08	0.4733	9.6291	2.8643	7.8728	23.7150	0.4832
	163.4358	290.1001	2065.3689	6.3336	43.1940	141.6263
	8.9947	45.2915	85.0285	7.4181	1.7832	5.5654
	3.2103	0.5590	4.6684	1.2041	13.3050	5.7120
BA10	0.3640	9.6258	3.0080	11.5352	24.2692	0.5435
	174.1756	271.4431	1016.6169	6.0154	32.6513	147.6734
	9.4274	35.5155	63.0464	5.9563	1.2234	4.6844
	1.8198	0.5012	3.7865	0.9774	11.9383	3.5689
BA11	1.2056	8.5936	1.3018	11.3750	23.8107	0.4422
	157.6354	262.2412	840.5945	5.7612	32.3570	123.6825
	10.0256	33.7103	60.1039	5.4790	1.2609	4.8194
	2.5909	0.4037	3.6900	0.9187	11.6451	3.5927
BA12	1.0179	7.8380	1.9666	10.3544	17.7217	0.4476
	104.9646	179.2675	969.3713	4.6402	21.4939	76.1736
	5.3117	28.4971	55.0716	5.3478	1.1933	3.9243
	2.6066	0.3493	4.4378	1.1492	10.7554	3.3721
BA13	0.3604	8.3400	3.2617	10.0129	21.8449	0.4857
	135.9906	255.8337	877.0652	5.5054	29.9884	131.6350
	8.7071	31.3211	60.5980	5.2873	1.3410	4.5093
	2.6215	0.3437	3.6213	1.1816	11.4311	3.3061
BA14	1.0285	7.1850	2.3066	9.9147	19.2228	0.4152
	104.7201	237.2035	1116.1509	4.9312	23.7382	67.9138
	5.3759	30.7022	62.8471	5.8582	1.6848	4.5868
	2.8793	0.3165	4.1083	1.2269	10.6622	3.8281
BA15	0.9704	8.6573	0.4280	11.5144	27.3976	0.4736
	167.1183	309.3606	968.7925	6.9250	34.5499	26.5239
	6.8888	37.8137	69.1589	6.5604	1.6743	4.7205
	3.1094	0.4784	3.8392	1.1149	14.0821	3.6698

BA16	0.7417	8.1451	2.3745	6.4694	21.6389	0.4567
	118.6174	254.2104	1248.4341	5.7147	28.1359	83.5832
	4.2900	34.4259	75.8289	6.2280	1.3377	5.5304
	2.8906	0.3400	4.5384	1.3627	11.9345	3.8480
BA17	0.4852	8.1581	1.7686	10.9499	21.8237	0.4544
	126.8760	249.8413	1044.0410	5.7625	27.6840	119.4557
	12.6771	36.2789	69.9427	6.4085	1.6014	4.2084
	1.9031	0.4296	3.4242	0.8900	11.9232	3.5778
BA17B	0.4351	8.3932	1.7680	11.2036	26.6097	0.5117
	119.8247	288.5483	973.3257	6.7317	36.6944	82.9262
	8.9148	35.4774	63.1215	5.8596	1.5822	5.1202
	1.9615	0.4990	3.8941	1.1430	13.5592	4.4449
BA17C	0.4481	8.3099	2.1969	10.7060	22.3840	0.4885
	123.3192	269.3860	990.8442	5.9125	27.7147	126.9088
	11.9671	35.6655	66.0289	6.3255	1.5466	4.5642
	3.7751	0.4404	3.6719	1.4304	12.2796	3.3744
BA18	1.1177	8.6281	2.8412	6.2443	21.8724	0.5084
	101.2205	230.2574	1183.3860	5.7946	25.0813	116.4403
	4.6468	33.1400	70.3957	6.3174	1.4282	5.0035
	2.1837	0.3027	4.9811	0.6666	12.2267	3.5603
BA19	1.0459	8.9904	1.1570	12.3079	26.4115	0.5264
	151.2352	282.4927	903.8411	6.5354	35.7802	50.3692
	7.4436	36.5575	70.0125	6.1493	1.2780	5.1062
	2.6855	0.4711	3.2949	1.1445	12.9618	3.2297

Black Glaze sherds from Mycenae.

MYC01	0.4368	8.9743	2.4535	12.0596	21.9945	0.5006
	145.2105	224.8513	909.8323	5.4575	27.2113	157.7676
	10.6493	34.1560	63.0889	5.5013	1.3055	4.7692
	3.7080	0.3578	2.9457	0.9440	11.4974	4.3460
MYC02	0.4898	9.8055	2.7673	5.4490	26.1525	0.5277
	126.0232	545.6572	707.3855	6.5305	40.0565	161.3882
	14.7649	36.9574	76.2203	6.5421	2.0207	5.0858
	2.7351	0.4731	4.0129	0.6754	11.6007	3.8304
MYC04	0.7291	9.6979	2.4996	6.1076	22.4094	0.5851
	123.4873	303.9490	1226.2981	5.8498	32.9148	141.9539
	9.5534	44.2567	84.2018	7.2077	1.8923	6.6322
	2.5601	0.4610	5.8316	1.0228	12.9858	5.0231
MYC05	0.4650	9.5970	2.0900	9.2657	22.0146	0.4471
	126.4308	289.7043	1321.5891	5.7029	33.7162	147.2440
	7.6111	44.5188	83.7236	7.2452	1.7361	5.5875
	3.0254	0.4736	4.8898	1.4432	13.5736	5.4400
MYC06	0.6029	9.2007	2.7016	5.7618	20.5998	0.4925
	112.6146	292.5774	1299.0459	5.5277	32.7689	133.4283
	7.4692	39.7021	83.1391	6.3486	1.5402	5.6049
	2.5300	0.4824	4.3171	0.9142	13.4791	5.0819
MYC07	0.7772	9.0195	2.2570	5.1865	22.5267	0.4850
	116.1024	271.1765	1188.9519	5.5466	32.2600	146.5109
	8.5815	42.3772	85.1048	6.8143	1.5736	5.6784
	2.7779	0.4120	4.9764	1.2959	13.5986	4.9955
MYC08	0.6212	9.7623	3.1104	6.5287	22.1549	0.5163
	130.9436	271.2253	1266.8401	5.8095	33.0984	170.6133
	9.2008	44.1749	86.6923	7.5274	1.7057	6.2364
	2.7565	0.4406	5.2388	1.1805	14.7168	5.6148
MYC09	0.5915	8.9987	2.8516	5.6951	21.7252	0.5255
	125.8538	264.7212	1165.3979	5.6051	32.0537	163.2327
	8.4759	43.6894	81.4620	6.7420	1.4238	5.5379
	3.0156	0.4389	4.9668	1.1680	13.7037	4.7390

MYC10	0.7268	8.2776	2.4989	6.6632	18.6650	0.4286
	103.6872	251.1999	1227.2339	4.8684	30.0798	137.1440
	7.1587	37.9722	73.7661	6.5149	1.3018	5.1603
	2.7010	0.4075	5.4996	1.0963	12.4703	5.4096
MYC11	0.6815	8.2351	2.7327	5.5158	18.2518	0.4292
	112.4709	255.5224	1060.0649	4.8086	27.0797	138.5715
	6.5651	39.4939	73.1205	6.0348	1.4052	5.4462
	3.2171	0.4720	5.1422	0.8860	11.5497	4.8324
MYC11B	0.6984	7.7593	2.6609	5.5113	18.8563	0.4291
	99.8120	251.5930	1055.2781	4.9594	28.9550	124.4791
	6.7518	40.6095	79.9843	6.4095	1.6630	5.0972
	3.0333	0.4525	4.9898	1.3136	13.2234	3.5208
MYC12	0.6408	8.5887	2.4861	5.7415	18.5016	0.4524
	113.2602	253.6780	1104.6130	4.7479	27.1066	135.2015
	7.8527	39.2630	74.5377	6.5821	1.1785	5.7063
	2.4492	0.4113	5.1552	1.3595	12.1615	4.5689
MYC14	0.6971	8.9412	2.4880	7.1332	19.8918	0.4598
	114.8006	269.8738	1355.4519	5.1759	33.3676	131.0196
	7.7031	42.7355	79.1892	6.3385	1.5136	6.0714
	2.9602	0.5235	5.1375	0.9711	12.2918	5.3162
MYC15	0.6299	8.7377	2.1481	6.1633	18.6742	0.4597
	115.0048	252.3900	1156.5979	4.8480	27.2063	134.9890
	6.6409	38.0447	73.5600	6.5887	1.3697	4.8406
	2.7398	0.4463	5.0528	0.9193	12.3392	4.8268
MYC15B	0.7057	8.3559	2.5335	5.8794	19.9691	0.4404
	117.8191	267.0178	1142.4470	5.1773	29.7460	145.0547
	7.0213	41.6715	84.4909	6.7225	1.4194	4.2963
	4.3638	0.5436	4.9519	0.0000	13.8030	2.8781
MYC16	0.4494	9.6584	2.1527	4.3370	19.9675	0.5738
	136.9145	170.0928	781.3062	5.5207	22.7098	150.3302
	6.4032	58.3201	108.7778	9.8578	1.9192	7.1097
	3.0460	0.6430	8.1334	1.8024	17.9156	4.2742
MYC17	0.7343	8.6038	2.0988	6.6695	20.8724	0.4295
	120.0509	260.2693	1234.4741	5.4107	31.3310	140.1368
	8.3673	43.6399	74.7978	6.4281	1.6643	6.2031
	3.3701	0.3107	5.0454	1.0727	13.0030	5.2321
MYC18	0.6723	8.2475	2.0624	6.3911	19.2595	0.4570
	105.0210	270.1216	1435.4260	5.0263	31.9803	127.5935
	6.6318	39.9181	71.7641	6.4609	1.5965	5.2072
	3.4456	0.3309	5.2213	0.5367	12.6484	5.7033
MYC19	0.6922	8.0046	2.1780	6.6433	19.3526	0.5016
	109.2540	262.0056	1317.1189	5.1618	30.8577	123.5514
	7.3401	40.9645	70.6237	6.6570	1.6253	5.7134
	2.7637	0.2906	5.5842	1.3267	12.1768	5.1991
MYC20	0.5566	9.3188	3.3590	6.4460	21.5606	0.5082
	120.9111	255.0137	1213.6609	5.5311	32.2886	165.0001
	9.2174	44.8348	83.2900	6.9789	1.5468	5.3369
	3.1934	0.5010	4.9186	1.0976	13.4660	5.2904

Black Glaze sherds from the German excavations at Tiryns.

T01/2	0.4839	9.4629	3.0381	4.0721	24.6483	0.5304
	127.7073	642.1499	846.1433	6.2640	41.6016	165.3830
	15.5709	33.9677	68.7022	6.6916	1.4909	4.8322
	2.6490	0.4303	4.0074	0.9781	12.9783	4.0361
T01/3	0.7189	8.7634	2.6131	3.9635	18.5493	0.5830
	116.7334	211.7195	446.3040	4.5288	22.9988	144.5999
	7.8912	40.2890	80.8711	6.7234	1.5433	5.3870
	3.5418	0.4417	6.3688	1.5458	13.5828	2.8257

T02/1	0.7183	9.0594	2.6174	3.5163	17.5442	0.5406
	136.0301	189.8309	528.5110	4.8546	22.1341	130.9931
	7.6887	37.5069	81.3595	6.7419	1.3728	5.9608
	2.7502	0.5108	5.9783	1.3789	13.7249	3.3324
T02/2	0.7435	10.2234	3.1402	3.0454	21.9065	0.5403
	139.2517	209.2369	419.1582	5.7390	23.3365	148.2474
	9.0541	46.0008	88.7242	7.6760	1.5282	5.5557
	2.9262	0.5090	6.7779	1.7667	14.9734	3.8063
T02/3	0.7251	9.8422	3.2359	3.8375	21.6650	0.5600
	134.5569	200.7604	434.4607	5.6888	22.5688	136.5533
	8.9647	46.3943	82.3038	7.5896	1.3930	5.7100
	3.7658	0.4792	6.2432	1.5171	14.9328	3.6540
T03/1	0.5053	9.1900	2.4705	4.1297	19.7110	0.5469
	125.8191	176.1174	545.0940	5.4135	24.8074	128.8784
	7.9464	52.0266	98.1486	8.5339	1.7904	6.8888
	3.7776	0.5512	6.1019	1.3574	15.7667	3.7782
T03/3	0.4046	9.1503	3.1747	4.5065	21.3713	0.4837
	124.0539	237.1619	833.1445	5.5993	31.4951	135.8038
	7.2413	51.1787	101.2409	8.5114	1.7688	6.5370
	3.6555	0.5303	6.5759	1.2850	15.2861	3.9115
T04/1	0.5110	10.0617	4.2684	5.0707	25.3539	0.5231
	123.0547	466.3281	900.6194	6.2013	35.0859	157.4514
	11.1809	35.0910	67.8112	6.9078	1.4446	5.0613
	2.8639	0.4159	3.9421	0.7282	12.1327	3.6800
T04/2	0.6211	9.1236	3.1864	4.3285	22.2019	0.5262
	115.5411	409.5801	1627.9131	5.9589	41.2712	135.5695
	10.6299	39.2419	72.0274	7.0804	1.3853	5.3730
	3.6578	0.4497	4.3882	1.0198	13.2183	3.9509
T04/3	0.6119	9.5231	4.0880	2.7394	23.4054	0.5400
	142.4525	313.5676	1616.3259	5.6832	36.0353	153.7183
	8.6254	40.3544	77.3395	6.9569	1.3224	6.0507
	3.1137	0.4775	5.0581	1.3316	13.1726	5.1188
T05/1	0.4971	9.6782	2.9323	11.3201	26.4379	0.5533
	158.3771	688.7749	924.2788	6.7188	44.6222	177.3910
	16.7015	37.2293	73.6905	5.8108	1.5992	4.8677
	3.1471	0.4106	4.2984	1.0491	13.9206	3.8811
T05/3	0.4615	8.8382	3.9060	7.8177	22.6822	0.5367
	128.9506	253.5758	753.9563	5.6690	26.4202	181.6005
	12.2176	30.4978	59.8963	5.6271	1.2237	4.2640
	2.5279	0.3679	3.4476	1.3012	11.8676	3.1367
T06/1	0.4177	8.9773	3.6089	10.3933	23.8553	0.4888
	131.9561	250.3592	1103.5959	5.8785	32.3625	154.0622
	12.0102	35.7172	64.3930	5.8523	1.0968	4.2401
	2.6954	0.4180	3.2215	1.7195	11.5271	3.7069
T06/2	0.5422	8.6810	3.0045	7.4721	21.7994	0.4915
	83.6722	510.7083	893.1187	5.8226	35.7552	131.8988
	12.2726	36.1560	72.1482	6.5813	1.4751	4.7817
	2.4716	0.4239	4.6305	1.1222	12.1572	3.8088
T07/1	0.5930	9.4742	2.9905	6.5943	21.1284	0.4395
	144.7947	283.7576	1633.2410	5.5074	34.7662	123.0150
	10.1363	42.6701	77.1585	7.6157	1.6298	5.8613
	3.2949	0.4477	4.7597	1.0305	12.5850	4.2280
T07/2	0.5967	9.1784	3.0363	4.1737	23.2899	0.5609
	122.9035	585.2712	841.3933	5.8909	38.4073	153.2565
	15.4219	35.5564	74.4885	6.8434	1.1912	5.2748
	3.1921	0.4324	4.3847	0.9122	12.2023	2.9234
T07/3	0.7493	8.2775	2.7143	5.2467	20.3803	0.4846
	116.2873	328.4390	1681.9561	5.4573	38.1627	120.9932
	8.5468	38.3726	75.2817	7.0324	1.4228	5.7344
	3.0047	0.4254	5.3292	1.0310	12.2566	4.6897

T08/1	0.6034	8.8739	3.8519	4.3273	26.8505	0.5051
	131.7877	650.9563	702.4866	6.6147	42.5325	162.6030
	15.3772	38.1958	82.3715	7.2793	1.3895	5.4549
	2.8546	0.4619	4.5280	1.1931	12.8862	2.7282
T08/2	0.4574	8.7747	1.9740	3.1495	19.4230	0.5204
	118.9289	270.0562	914.3845	5.5349	27.3109	122.7959
	7.3314	51.4141	104.4689	8.9065	1.8539	5.5453
	3.0953	0.5153	6.6806	1.3731	15.8038	3.6868
T08/3	0.2682	8.5257	1.7006	6.4140	20.6771	0.5060
	139.9559	237.4223	1495.2739	5.2702	38.1231	136.9552
	9.5523	40.6107	77.0205	7.6615	1.4930	5.5993
	2.8564	0.4505	4.8926	1.1026	14.1116	4.1167
T09/1	0.7104	8.5047	2.1591	7.2553	21.6818	0.5478
	137.6369	249.2911	1170.4580	5.4949	30.2652	135.7544
	7.6731	33.4684	70.2592	6.1161	1.6527	5.2885
	3.9355	0.4265	3.4873	0.5168	11.5152	5.0175
T09/2	0.5966	9.2585	2.8294	4.9439	22.8117	0.4906
	128.6040	284.5156	1592.7781	5.9868	33.8990	156.8485
	9.0984	50.6247	92.5583	8.5009	1.7670	5.9862
	2.6178	0.3511	5.1728	1.2917	16.1977	6.0326
T09/3	0.5941	8.8018	2.9202	4.0202	19.6527	0.5991
	114.2283	196.0847	548.1936	5.2638	24.7422	143.0250
	8.2260	51.2228	98.3167	8.5958	1.7602	6.9031
	3.7492	0.5446	6.3858	1.3991	15.8655	3.6480
T10/1	0.6597	9.0902	3.0535	4.0375	19.3379	0.4903
	125.8106	184.2885	428.3347	5.3825	19.9081	144.3937
	6.7201	42.9210	80.0237	6.7459	1.4071	5.5090
	3.3001	0.4703	6.0221	1.1972	13.7811	3.4377
T10/2	0.6162	9.0600	2.9075	5.3401	21.3419	0.5118
	125.5889	277.7300	1560.3660	5.5917	31.4095	138.1268
	8.6568	46.1846	83.2823	7.3028	1.4734	4.7202
	2.8349	0.4367	5.3441	1.1478	12.7169	5.9215
T10/3	0.6661	9.2637	2.8815	4.5896	20.0877	0.5344
	127.8459	234.9221	1317.6980	5.0453	29.6665	147.4343
	7.7213	43.1103	80.2760	7.1103	1.4901	5.0729
	3.0694	0.3977	5.5917	1.5892	13.7446	5.3669
T11/1	0.7500	8.4015	3.0512	3.7133	18.9978	0.5473
	99.9969	214.5304	548.7461	4.9067	23.6680	141.2766
	7.4144	42.0845	87.1499	6.9231	1.4345	5.3990
	4.5491	0.4837	6.5020	1.3723	14.0584	3.3235
T11/2	0.6362	8.5527	2.3213	4.9226	21.3636	0.4338
	125.5771	289.1404	1565.0530	5.4404	33.9188	124.5677
	7.7293	44.3080	81.9580	7.4256	1.5033	6.5068
	3.9574	0.4783	4.8025	0.9647	12.9596	5.7174
T11/3	0.7256	9.4688	2.8588	4.1507	21.0620	0.5195
	146.7894	200.8747	434.8755	5.7039	21.8818	151.4548
	7.3088	44.3023	87.0049	7.1602	1.7504	6.0064
	3.4357	0.3763	6.9841	1.6306	14.6419	3.4305
T12/1	0.8189	8.2136	2.3287	5.2296	19.2742	0.5076
	99.4134	237.3918	476.1501	4.7320	22.7551	133.7332
	6.8075	40.5101	80.3545	6.5932	1.4646	5.4627
	3.6444	0.4345	6.6239	0.9816	12.6908	3.3832
T12/2	0.5264	9.0327	2.8264	6.9943	24.8895	0.4801
	125.7919	536.7725	943.7974	6.1928	38.0412	145.2933
	13.0077	37.9040	69.4635	6.6848	1.3241	5.4614
	2.5715	0.4691	3.4499	0.6563	12.0853	4.5967
T12/3	0.8875	6.3096	1.5718	11.7936	16.3058	0.3796
	79.9124	431.4395	583.7339	4.1196	17.6826	72.6813
	5.8660	25.3076	39.1913	4.1282	1.0709	3.9766
	2.8833	0.2784	3.4560	0.7590	7.5399	3.4597

T13/1	1.2608	8.6886	2.4189	9.2862	23.2138	0.5141
	126.7032	248.0838	1241.5779	6.0061	26.9715	141.8067
	6.4174	35.7439	75.7465	6.3412	1.3220	4.9220
	2.8781	0.4065	4.3907	0.9213	11.9553	5.3987
T13/2	0.8729	7.8633	2.4765	8.2636	20.2527	0.4407
	104.9961	228.5051	1148.3030	5.1782	22.0739	90.4967
	5.8959	34.5499	65.6873	5.7995	1.7002	4.5466
	3.4201	0.4774	4.3173	1.2796	11.2620	4.9219
T13/3	0.7797	6.9762	2.2735	10.9786	19.0602	0.4430
	99.9480	277.4539	1496.8811	5.0113	27.1104	101.2773
	6.2917	36.3593	66.0975	6.2935	1.5085	4.7977
	2.5419	0.3665	3.6688	0.7385	10.0579	6.0227
T14/1	0.7437	8.4138	2.4662	3.7606	21.0983	0.4975
	129.8128	249.9938	1055.8000	5.3925	28.2721	140.5293
	7.7165	46.1593	83.3481	6.6221	1.2455	5.0209
	3.1041	0.5488	5.7811	1.1666	14.2128	4.7577
T14/2	0.4810	10.5237	2.5970	3.1853	21.1337	0.6482
	139.3056	152.0818	912.5708	5.6131	21.2405	126.9186
	6.6342	61.8158	121.2089	9.7238	1.7803	7.2246
	4.1459	0.5784	7.5512	1.8196	17.7492	4.5672
T14/3	0.5337	11.1344	2.5098	2.9984	22.7356	0.6803
	141.9624	137.6892	832.0356	5.8792	22.1251	145.1683
	7.1101	65.5114	136.1896	10.5275	1.9093	8.4162
	3.5542	0.5697	7.8448	1.6226	19.1616	4.4743
T15/1	0.7361	9.8115	3.1728	3.4448	20.2161	0.5212
	135.4810	197.4180	446.9097	5.5753	20.7659	151.3042
	8.3052	45.3374	86.1285	7.5417	1.5180	5.5658
	3.3373	0.4866	6.4473	1.7863	15.4768	3.5011
T15/2	0.5093	10.9468	2.3275	3.0482	22.4506	0.6262
	144.1035	141.7980	925.2158	5.9780	21.9067	151.5785
	8.2784	63.7657	129.8040	10.6275	1.8698	7.7019
	4.5095	0.6104	7.4400	1.7351	19.9628	4.6383
T15/3	0.5754	9.5893	3.3783	3.7344	22.9080	0.5596
	122.1340	440.3052	768.7380	5.6698	32.0398	167.0789
	11.9653	34.8424	71.2019	6.1956	1.2587	4.7677
	3.7634	0.3015	4.6702	0.7921	11.7552	4.3040

Samples from the British Museum.

Argive Geometric sherds from the Argive Heraeum.

BM76	1.1411	8.3558	1.8296	8.9423	21.1302	0.6178
	131.3080	230.3546	1066.6370	5.4522	24.6616	141.9644
	9.0595	32.2454	69.4019	6.4740	2.2675	5.7540
	1.5400	0.3176	4.1216	0.0000	12.0555	5.2803
BM83	0.9739	8.2240	2.5235	8.7422	22.6926	0.4548
	112.7105	247.8349	1041.5559	5.7176	28.8228	72.9734
	9.2308	33.7364	79.4918	6.8920	2.6187	5.3034
	2.5947	0.6537	4.5778	0.0000	12.0812	4.5369
BM90	1.1616	8.4413	2.3277	8.1202	20.1919	0.4458
	120.9712	226.5947	1055.6609	5.0100	23.5667	100.5911
	7.5694	31.8774	72.8046	6.4271	1.5216	5.0622
	3.6430	0.4708	4.1756	0.0000	11.2525	4.9740
BM93	1.0676	7.8978	2.1836	5.9769	19.8938	0.4918
	83.2863	223.7646	1110.9390	5.1136	25.0464	111.0047
	5.8341	34.1833	80.3626	6.3862	1.8987	4.7393
	3.1367	0.4386	4.3445	0.0000	10.3811	4.8519
BM95	1.4298	8.3039	1.2307	11.0042	21.5317	0.4424
	119.4196	252.3536	1015.7590	5.5375	25.9417	127.3164
	9.0630	34.6650	61.6609	6.1633	2.8779	3.7085
	2.8203	0.4670	4.4192	0.0000	11.5179	4.9064
BM107	0.8710	8.8733	2.5214	9.6449	21.3427	0.5108
	122.2989	227.5386	1025.9131	5.4304	24.1287	135.9180
	9.9026	33.3590	71.1352	6.9869	2.0077	4.7821
	2.9913	0.3599	4.1449	0.0000	11.5862	5.0409
BM111	0.9284	8.6580	2.5698	9.1434	19.7701	0.4957
	97.9449	195.0538	1038.4990	5.0967	22.7992	138.2999
	6.4319	32.4043	54.8727	5.8058	1.8361	4.3533
	0.6257	0.5254	3.7876	0.0000	11.2639	5.0556
BM115	1.1239	8.2087	2.2238	9.3287	19.4703	0.4619
	103.7803	219.6056	911.9314	4.8544	22.1778	118.2067
	7.1757	33.6065	66.5873	6.7014	2.2312	4.4422
	2.6610	0.4486	4.5424	0.0000	11.9141	4.3957
BM118	1.0917	8.2920	2.4926	8.9439	19.9264	0.4696
	107.7279	221.4649	997.3633	5.2057	24.1096	106.6006
	9.7570	32.2114	60.5405	5.6484	2.0597	4.4001
	2.8589	0.3967	4.9228	0.0000	9.8808	4.7331
BM122	0.9398	8.4667	3.0485	9.4323	20.7325	0.4864
	123.8498	218.2572	1223.1050	5.2342	25.3965	127.1422
	7.4071	30.4936	58.4491	6.0848	1.6955	4.1931
	2.0149	0.6064	3.2410	0.0000	10.5433	5.5085
BM234	0.9339	8.0670	1.8793	7.8235	18.6404	0.4377
	112.7615	207.0431	1029.7019	4.6981	23.6236	124.8942
	6.9469	31.1264	54.3557	6.0612	1.9867	4.6662
	2.2147	0.4390	5.2796	0.0000	11.5188	4.7776
BM241	0.8838	8.4693	2.3689	7.8269	19.7029	0.4796
	110.9642	232.4413	1045.7119	5.0881	23.3623	117.4469
	6.8857	33.3324	72.7918	6.4645	1.6302	4.1272
	3.4257	0.4113	5.0302	0.0000	11.0650	4.8108

Samples from the Swedish excavations at Asine.

UP01	0.8198	8.4012	2.8177	9.1725	20.9741	0.4307
	111.3569	188.3384	1073.1060	5.3655	24.7325	101.4851
	5.5373	26.9307	63.8204	5.3574	1.5573	4.7726
	2.5140	0.2420	3.8138	0.9315	11.2229	4.2650
UP02	1.0468	7.4032	2.1909	8.8452	18.1071	0.4788
	111.7545	190.2616	905.0710	4.6526	21.3788	111.6554
	5.0889	33.6002	55.9345	6.3349	1.4289	4.6982
	3.9458	0.4251	4.4780	0.8284	10.7539	3.4803
UP03	0.7279	8.6573	3.5481	3.9413	18.6812	0.5224
	115.3166	175.1572	547.7527	4.7172	19.3487	151.5522
	8.9367	35.9855	70.2006	5.9024	1.3441	4.6169
	3.4818	0.3775	4.2335	0.9817	12.2610	3.1652
UP04	0.8295	8.9989	2.8899	5.5940	18.5709	0.4990
	109.3615	195.4366	793.9309	4.7026	22.4239	148.2748
	7.9658	33.2913	65.9185	5.9813	1.2710	4.9198
	3.1835	0.4864	4.9030	0.7607	13.4116	3.2811
UP05	0.9702	7.8613	2.4625	7.6684	19.0886	0.4819
	107.4013	199.7765	959.4460	4.7591	21.3404	107.7363
	5.3528	29.2568	62.6854	5.8523	1.7898	4.7956
	2.0008	0.4591	4.0450	0.9585	10.9548	3.2670
UP06	1.0236	7.7901	2.3620	8.1748	18.2080	0.4421
	97.3536	194.0675	976.3992	4.6555	21.7884	101.2492
	5.3623	29.9132	60.3130	5.8195	1.3297	4.6268
	3.0531	0.3255	4.5631	1.0194	10.9681	3.7440
UP07	0.8910	9.1885	3.8647	4.1538	20.2975	0.4783
	115.7489	233.4936	630.7141	5.1880	24.2601	150.1822
	8.8314	35.5742	69.1414	5.6784	1.2836	4.6670
	3.2421	0.4081	4.6286	1.2068	13.0580	3.0258
UP08	0.5733	8.0214	2.6119	6.0101	24.7409	0.4982
	126.9948	652.4971	819.1672	6.1632	36.9060	131.8770
	18.6266	25.8404	56.2549	5.3612	1.1026	4.3076
	3.7388	0.3479	4.2932	0.9774	9.8079	3.5003
UP09	0.8067	8.1877	2.9966	10.0971	22.2014	0.4596
	126.2373	285.8169	872.0845	5.7876	32.2796	119.2808
	9.0472	30.1237	57.4522	5.2887	1.2167	3.7974
	4.6424	0.3632	3.5109	0.9985	11.1730	3.1343
UP10	0.6447	8.6255	2.5282	9.8013	22.3163	0.4536
	138.1450	233.1823	1235.6909	5.7233	27.4885	135.2453
	9.0728	34.5977	64.7465	5.7300	1.4162	4.2925
	4.3307	0.3001	3.9065	0.5805	11.5906	3.3959
UP11	0.5707	8.9902	4.1278	2.8429	25.0403	0.5093
	118.6617	545.3184	670.8550	6.0647	34.3302	168.7623
	12.9173	35.9061	81.0071	6.5552	1.2158	4.6721
	3.1726	0.3101	3.8817	1.0109	11.9855	2.8324
UP12	0.3924	8.8036	3.1613	8.0980	25.3093	0.4689
	162.0574	283.6189	811.3457	6.0047	33.6152	182.7070
	10.5936	36.1923	65.9675	5.8856	1.4180	4.3818
	4.0516	0.3527	3.9148	0.9347	12.9983	3.2181
UP13	0.6853	7.1251	2.6125	12.9321	19.8906	0.3751
	119.6615	276.4375	802.5203	5.1018	27.2834	126.1096
	8.2270	29.0122	62.7404	4.8776	1.4215	3.1314
	3.4789	0.4231	2.8753	0.4781	9.5186	3.2548
UP14	0.6038	8.0646	2.8336	10.8788	21.3257	0.4123
	132.5718	241.7001	868.6421	5.4718	28.5298	144.2690
	9.9612	32.7704	62.7613	5.6682	1.3865	2.8492
	3.2185	0.3768	2.7793	0.8432	10.9569	3.2594

UP15	0.7232	8.1138	3.6494	5.2736	18.9499	0.5191
	119.7327	166.8014	502.4414	4.5457	18.5170	155.6469
	8.4956	34.5408	64.9644	6.0252	1.3855	5.0275
	3.2576	0.4310	4.6326	1.1571	12.5590	2.8840
UP16	0.5119	9.5659	3.1559	2.9930	26.3751	0.5196
	131.0074	567.0024	686.6252	6.4842	41.3171	167.5266
	12.9305	37.4798	81.3382	6.7833	1.4317	4.6083
	2.7840	0.5590	3.5316	1.1144	13.1741	3.2347
UP17	0.6622	8.2703	3.1094	10.0295	21.6653	0.4684
	119.8641	264.2156	886.2187	5.8808	30.0599	139.5686
	9.0625	35.2065	66.3671	6.1316	1.3831	4.6180
	4.4058	0.2395	3.6220	0.5594	12.2818	4.3050
UP18	0.5652	9.7091	3.6383	5.0953	27.5464	0.5039
	124.8862	512.8516	934.3196	6.6055	38.3695	161.2666
	11.4378	34.9083	71.4799	6.2121	1.3539	4.4292
	2.3064	0.4309	3.8715	1.0835	13.0702	3.4547
UP19	0.5095	9.5280	4.1804	4.5095	27.0426	0.5078
	124.4550	726.4060	856.4902	6.8846	44.8800	151.5901
	16.5419	35.8765	72.8963	6.9383	1.5666	4.3210
	4.6810	0.4284	3.5655	0.8569	13.5192	2.7907
UP20	0.6047	8.8765	3.1948	5.5945	21.6475	0.4624
	114.2903	288.3521	1570.3760	5.6222	36.3205	145.9259
	9.1805	43.3051	76.6857	7.7256	1.7526	5.7424
	3.0505	0.4193	4.5827	1.3511	13.7651	4.7628
UP21	0.4356	9.1210	3.1326	8.4158	26.7664	0.5663
	161.3546	292.8672	905.5176	6.4058	35.6919	187.2889
	11.9351	38.1191	62.6793	6.1154	1.1671	3.9748
	3.6339	0.4963	4.2470	1.1028	13.6804	3.8390
UP22	0.7356	8.9772	3.7811	5.1657	23.0254	0.4951
	115.4949	310.6572	1893.2390	6.0161	38.8488	134.5281
	9.4140	41.7154	83.7140	7.5942	1.6876	6.4264
	4.1672	0.3971	4.9721	1.1242	14.2345	4.8213
UP23	0.4934	8.6500	3.2527	9.4676	25.2229	0.4425
	151.1779	277.3386	979.1987	6.2290	33.5654	148.5482
	10.2545	38.2912	68.0965	6.2170	1.4522	4.6274
	3.6478	0.3998	3.3624	0.8169	12.8002	3.5218
UP24	0.8277	10.2787	3.6575	2.0828	24.5864	0.6045
	120.5187	194.2233	391.8486	4.8527	25.4460	159.5970
	8.1763	39.5212	81.9949	6.7229	1.2911	5.2652
	3.5926	0.3991	6.6650	1.6923	13.5118	3.5693
UP25	0.9312	8.0451	3.8151	4.5749	19.7622	0.4517
	119.4522	286.2078	1364.6570	5.2231	31.1546	141.2422
	7.2155	39.5854	79.3639	6.7287	1.3427	4.6249
	2.9403	0.5138	5.1412	1.2744	12.5145	4.3139
UP26	0.8199	8.2754	2.6383	6.0342	18.4879	0.4296
	106.3242	279.4934	1418.6489	4.9096	30.8068	120.9607
	6.7110	36.6014	75.8930	6.3470	1.3855	4.6941
	3.1092	0.4459	5.4406	1.1922	12.0534	5.0059
UP27	0.6995	10.0052	3.0736	3.5884	23.1100	0.5592
	138.1268	315.0645	1639.7781	6.2717	35.8246	173.1841
	8.7459	41.0589	76.1101	6.7712	1.5069	6.3569
	3.2125	0.4623	4.9539	1.2321	13.3802	5.5372
UP28	0.5547	9.7293	4.0677	4.2349	24.5319	0.5343
	126.6024	511.7769	737.7727	5.9229	37.6602	166.4984
	12.6388	35.6837	73.5197	6.4726	1.6053	5.1801
	3.2881	0.3867	4.1179	0.9925	11.9563	3.2999
UP29	0.4557	9.9174	4.2543	3.7081	21.8461	0.5904
	134.0137	186.4916	1133.8459	5.9156	25.7628	147.8393
	8.1807	47.8259	102.6464	8.2031	1.9775	6.5951
	3.0865	0.5419	6.4257	1.3636	16.0830	5.0385

UP30	0.7607	9.2999	3.0203	4.8680	23.1557	0.4715
	94.9162	311.5220	1724.9409	6.1326	37.9517	144.3768
	8.4064	40.6125	76.3615	6.8338	1.5761	5.2696
	2.8847	0.5085	4.8166	1.2966	13.1122	5.2353
UP31	0.7155	9.5091	3.1768	5.3893	23.0301	0.4588
	161.3993	289.1697	1222.8350	5.9357	32.8444	140.6147
	8.2141	46.0528	84.3994	7.3004	1.6406	6.3154
	3.3919	0.4079	4.9269	1.2470	13.0718	5.2948
UP32	0.9477	9.4573	2.9230	4.1959	19.3180	0.4469
	119.4571	254.8900	1017.7671	5.0429	27.1078	146.4107
	7.5875	40.5185	78.7905	6.6993	1.4304	4.9126
	3.6528	0.4729	5.1656	1.1819	12.9712	4.2744
UP33	0.7688	8.1417	3.2932	6.2785	18.9480	0.4798
	103.1731	232.1099	1211.6631	4.9958	29.2358	142.3143
	7.2499	38.2907	76.8995	6.5376	1.3849	5.4634
	3.3635	0.4316	5.0421	1.1430	12.5214	3.9890
UP34	0.9750	9.0585	4.0013	4.8583	20.4465	0.5171
	117.8391	215.9115	710.0227	5.1490	23.9336	158.2134
	7.6266	36.8286	78.6718	6.0183	1.4441	4.2975
	2.7133	0.4435	4.7969	1.1802	13.3512	3.7296
UP35	0.7343	8.1576	2.3209	6.6677	18.2561	0.4906
	87.4835	263.8330	1294.8181	4.8340	29.4469	129.1295
	7.5699	36.6578	71.9186	6.3177	1.3149	4.8367
	2.8657	0.4610	5.3563	1.1973	12.2906	4.5225
UP36	0.6759	8.3324	3.4633	6.0719	20.4057	0.4861
	106.9392	271.8352	1085.3569	5.2440	29.7071	142.3687
	6.8841	39.1452	76.0887	6.3860	1.3735	4.7718
	3.1083	0.3918	4.7845	1.1181	12.5873	4.8489
UP37	0.7984	10.5720	4.4249	10.3526	20.1252	0.6515
	139.2541	201.5463	553.8940	4.9048	21.1496	158.4362
	8.0687	34.7850	71.2849	5.4453	1.2488	5.8572
	2.6250	0.3853	4.1760	1.0785	12.6304	4.3669
UP38	0.7404	10.5066	3.3415	7.9665	20.8096	0.6339
	154.7615	262.4678	1624.5969	5.3551	31.3292	143.8727
	7.8793	41.7212	77.4746	6.9622	1.5154	6.3985
	2.7909	0.4808	4.9264	1.3390	13.7185	6.8347
UP39	0.6394	10.4969	4.2746	7.3992	24.1920	0.5859
	177.5586	258.0342	1130.1150	5.9340	31.9889	159.8615
	10.0483	34.1660	68.7195	6.2897	1.4049	4.8863
	2.9094	0.4187	3.3754	0.8960	12.8558	5.5215
UP40	0.8275	11.4103	5.2102	6.4930	19.9520	0.6438
	155.5233	153.1283	474.9468	4.4085	14.7319	187.7837
	9.4479	38.6722	80.9229	5.9215	1.1421	5.7198
	2.8836	0.3776	4.7150	1.2023	15.6522	4.3440
UP41	0.7882	7.4762	2.9661	2.9305	18.4490	0.4755
	95.4812	158.9701	445.0044	4.8164	18.8417	171.0667
	9.3882	33.8275	71.6796	5.8662	1.3581	4.4843
	2.6639	0.4018	4.5501	0.9920	12.5771	3.1909
UP42	0.6941	9.8530	3.8787	6.9803	25.3581	0.6471
	154.8513	672.6453	1034.6799	6.6547	42.8342	157.4362
	17.3062	25.8466	55.9649	5.3129	1.0385	4.5908
	2.7117	0.3913	4.7898	0.8363	10.0501	5.2032
UP43	0.7275	5.9917	1.7544	8.8337	19.9058	0.3316
	92.8104	252.0773	659.6995	5.0438	27.4158	155.6729
	9.0647	29.3988	53.9404	5.1295	1.3099	2.9584
	2.4425	0.3894	3.8884	0.7793	10.9171	3.5967
UP44	0.7106	7.9476	2.4403	12.4293	19.1567	0.4391
	126.4039	236.8698	866.5369	4.8051	26.7759	124.9882
	8.5778	27.6114	55.8128	4.5571	1.3417	3.5616
	2.8962	0.3454	3.3263	0.6855	8.7717	4.7536

UP45	0.7040	9.8742	3.4989	3.2645	23.7847	0.5231
	143.1099	329.2678	1600.7051	6.4527	36.9811	147.8235
	9.1034	41.3415	78.9968	6.4946	1.4310	5.5408
	2.5387	0.4929	5.1413	1.3583	14.0866	6.3986
UP46	0.4648	10.4779	3.8995	4.1237	22.8259	0.6434
	133.0958	193.1860	1105.0071	6.1205	26.1134	171.4839
	8.6816	51.2904	107.5685	9.0562	1.8432	7.4638
	3.6533	0.5694	6.6706	1.7980	16.5054	5.0177
UP47	0.7765	7.8638	2.7872	4.5258	22.4047	0.4402
	97.5529	298.3564	1689.8911	5.9899	38.7305	137.2852
	7.5247	40.6707	75.4529	6.7659	1.4789	5.1526
	2.9006	0.4821	4.9680	1.3582	13.4413	6.7518
UP48	0.6852	7.8208	2.9927	5.2118	20.5486	0.4451
	107.9139	274.3430	942.3115	5.2565	30.6476	140.9406
	7.5102	40.8113	80.3256	6.9789	1.3318	6.1829
	2.4093	0.4358	4.8135	1.4914	13.0669	4.4564
UP49	0.7573	9.1928	2.6068	5.3621	20.7781	0.4521
	150.6781	292.1621	1217.8040	5.3470	31.3977	136.7008
	7.5539	40.7085	81.6289	7.0378	1.2424	5.3857
	3.0934	0.4078	4.2482	0.0000	12.9017	5.1418
UP50	0.7895	8.9570	2.4704	6.3735	20.5696	0.4681
	115.5497	256.2373	1245.3960	5.2970	30.4554	127.6220
	7.7158	40.6847	80.2037	6.4776	1.3566	4.8328
	3.3741	0.3870	5.2442	0.0000	12.5519	5.2923
UP51	0.7297	8.9599	2.9606	5.8665	18.8935	0.3851
	118.3608	277.8870	1412.8430	5.0276	30.3480	117.8246
	7.6008	46.5219	84.6066	8.3963	1.6162	5.8389
	3.4531	0.4428	4.5955	0.0000	11.5557	6.0577
UP52	0.8122	10.6163	3.9337	5.8491	20.1981	0.5258
	126.0999	153.0143	451.9485	4.6574	16.6272	195.8734
	10.5322	38.2901	82.0729	6.2308	1.0969	5.2558
	2.4670	0.3968	4.7628	0.0000	17.1838	3.6809
UP53	0.5216	8.8404	3.5011	4.4624	26.1526	0.5321
	127.6304	748.6218	828.5986	6.8506	44.5184	149.9425
	16.6390	31.2941	72.7203	5.8088	1.0875	4.4962
	2.2343	0.3674	3.6638	0.0000	11.7058	4.2538
UP54	0.7026	9.6457	3.3717	3.5927	23.4414	0.4702
	146.8102	347.1377	1571.0991	6.3057	35.5866	140.5495
	8.1917	41.2809	77.0815	6.5310	1.3083	5.6120
	3.3817	0.4645	4.9928	0.0000	13.6621	6.1441
UP55	0.7226	9.9791	2.9334	3.5649	24.7653	0.4486
	132.4239	344.8730	1538.0371	6.6707	37.3520	138.2812
	8.3385	42.1252	82.0160	6.6955	1.3689	6.0246
	2.9439	0.4795	4.8092	0.0000	13.6145	6.1677

Argive and Corinthian Handmade wares.

Handmade wares from Tiryns.

OM101	0.2904	8.9691	2.9377	9.3562	23.2948	0.5084
	170.2021	249.5705	969.2107	5.7576	28.4288	159.9637
	10.4426	31.6290	59.8250	5.0612	1.2589	3.7286
	2.8269	0.3890	3.1278	0.0000	10.1432	4.4025
OM102	0.3326	9.9929	3.1360	9.7477	25.7613	0.4721
	184.9724	271.3245	877.6150	6.3528	33.9515	206.2017
	12.1645	36.3594	71.1254	6.0862	1.5841	4.1555
	3.3120	0.4640	3.8502	0.0000	12.7802	4.4281
OM103	0.3164	9.5878	2.8501	9.5023	24.0351	0.4844
	175.9825	249.5526	872.7688	5.9960	30.5297	177.5184
	11.1417	33.7215	63.1847	5.1974	1.3487	4.7851
	2.6219	0.3885	3.2723	0.0000	10.9825	4.5809
OM104	0.3063	9.8305	2.9692	9.8447	23.8886	0.4916
	171.2565	252.3630	785.4653	5.9021	29.0801	157.8760
	11.5877	33.8587	68.0714	5.2228	1.1051	4.2297
	3.4738	0.4220	4.0147	0.0000	11.7396	4.3073
OM105	0.3705	8.9569	2.7899	9.2129	22.1347	0.5034
	143.0471	246.3869	793.9951	5.5533	27.1527	152.7367
	10.6214	32.4400	62.2261	5.0744	1.4861	4.3778
	2.1321	0.3759	3.1160	0.0000	11.3013	4.2999
OM106	0.3158	9.5512	2.9840	9.1506	25.3864	0.4785
	168.4739	274.9238	842.1306	6.3427	30.5380	168.9786
	12.5143	36.2246	66.0867	5.7015	1.4170	4.5399
	2.3256	0.4487	3.6277	0.0000	11.7668	4.4516
OM107	0.4663	8.9257	2.1431	9.8451	21.4347	0.5220
	134.0355	238.4793	907.0408	5.6572	30.0517	175.6601
	8.7614	30.8218	56.7617	5.8134	1.1709	4.4868
	1.8588	0.5190	3.2921	0.0000	10.6333	4.6273
OM108	0.3663	8.7710	3.1950	9.7652	24.2925	0.5039
	147.0936	268.0381	889.0398	5.9426	29.9806	180.1210
	11.0494	35.3641	61.3584	5.8930	1.1300	4.2650
	2.5737	0.4571	2.7506	0.0000	11.9909	4.4912
OM18B	0.4245	8.7213	3.2546	9.5991	25.1963	0.4570
	151.6100	279.8838	893.7954	6.3023	32.6123	167.4347
	9.8860	35.6540	70.3033	5.6210	1.2354	4.0213
	3.2227	0.5314	3.5018	0.0000	12.1537	4.3848
OM109	0.4766	8.0246	2.5567	8.6512	21.2422	0.4879
	143.7366	222.4246	1022.4221	5.6269	24.8357	137.4312
	9.8700	30.7652	55.3019	5.1573	1.3882	4.7160
	2.6241	0.4508	3.1767	0.0000	11.1163	4.8845
OM110	0.4826	8.4459	2.7918	8.9380	21.1879	0.5086
	140.7058	219.3864	1038.0120	5.5096	24.6981	132.5991
	9.6452	31.7301	63.3946	5.6294	1.1653	4.4393
	2.3236	0.3481	3.6525	0.0000	10.8693	4.8967
OM111	0.3321	9.3147	2.9344	9.4998	25.0544	0.4909
	165.7211	275.5864	839.6777	6.2656	32.7240	155.4866
	11.5968	35.6605	65.8870	5.4325	1.1497	4.2121
	3.7016	0.3697	3.0716	0.0000	12.6395	4.0914
OM112	0.5719	8.2524	2.6637	8.4390	22.0778	0.4980
	144.4737	262.5479	941.6006	5.8741	30.6354	143.3735
	10.1186	33.7776	68.2392	5.5937	1.7269	4.2002
	3.9379	0.2855	3.6744	0.0000	11.5548	4.6702
OM113	0.4606	9.1436	3.4416	6.4907	21.9862	0.5117
	142.4910	242.6022	636.5461	5.2458	26.5609	172.4416
	9.0964	31.2786	62.3486	5.1746	1.3753	3.9821
	3.6961	0.4066	3.5560	0.0000	11.4681	3.8575

OM2A01	0.7605	7.4992	1.8541	0.8387	16.6624	0.4177
	107.7966	247.6398	766.2656	4.4447	18.3914	87.3453
	4.9273	29.2239	52.2550	5.7244	1.4123	5.0285
	2.7417	0.4062	4.9234	0.8680	10.0705	2.8248
OM2A02	0.7547	7.9584	1.5635	1.0554	18.9951	0.4125
	115.6051	433.7942	338.5825	4.7298	24.6469	77.9532
	5.2097	29.3671	71.1661	7.2480	1.6860	6.3637
	3.2034	0.5174	4.5509	0.5702	8.7039	2.1710
OM2A03	0.7609	7.8393	1.6997	0.8339	16.2515	0.4173
	103.0500	237.7879	772.7930	4.3714	17.9846	85.0759
	3.9383	28.3911	56.7637	5.5316	1.2948	4.5025
	2.3467	0.3752	5.2319	0.8720	10.1176	2.5735
OM2A04	0.7759	7.8139	1.6159	0.6964	16.1133	0.3791
	104.1831	206.8917	925.6543	4.3406	18.1888	79.1626
	4.3977	28.6803	53.2575	5.1490	1.3077	4.2819
	2.5889	0.3148	4.7794	1.0898	9.3689	3.2030
OM2A05	0.7671	7.8075	1.6076	0.8724	17.1946	0.3920
	103.6562	192.0197	737.6067	4.5366	16.4431	85.2468
	5.1704	27.8055	53.0541	5.3137	1.5080	4.5666
	2.7876	0.3749	4.4386	1.1025	9.8612	2.9719
OM2A06	1.2348	6.7915	1.9968	1.5958	15.6916	0.3991
	95.9262	190.3563	588.9658	4.2478	16.8795	89.7433
	4.0890	27.7064	52.7980	4.9269	1.1372	4.0713
	2.4217	0.3652	4.7360	0.9783	10.5065	2.7509
OM2A07	0.8804	8.9075	1.7130	2.2069	19.4506	0.3897
	100.8225	172.1105	380.4463	4.4310	10.1055	77.2659
	5.0033	34.1512	71.7759	5.9218	1.4644	5.2675
	3.4312	0.5271	5.1337	1.1087	15.8633	2.8462
OM2A08	1.0212	7.8891	1.6631	1.8598	17.2246	0.3172
	90.8559	86.5613	804.4929	4.7013	13.7901	23.4522
	2.0346	21.6408	45.1946	4.4199	1.3774	4.0409
	2.8381	0.4205	4.7537	0.5474	6.5086	2.7747
OM2A09	0.9724	7.5336	1.8205	1.1859	17.6708	0.4489
	104.9978	204.1638	540.9026	4.8045	20.2733	119.7148
	4.8019	30.1777	68.0886	5.3883	1.4969	4.0244
	2.1880	0.4035	5.7923	1.4340	12.2605	2.3212
OM2A10	1.0897	7.5892	1.6521	1.3059	17.5383	0.3626
	107.1292	168.0659	580.8813	4.6034	16.3300	89.3614
	4.8524	25.5014	52.9387	5.0121	1.3957	4.6983
	2.8578	0.2980	4.5443	1.1490	11.1992	2.5330
OM2A11	0.8308	7.2089	1.9766	0.8772	16.9014	0.4366
	95.1954	231.6089	693.1506	4.7373	19.4578	107.7012
	5.2364	32.3511	65.1621	5.4956	1.4490	3.5573
	2.9341	0.3535	5.8486	1.4711	11.8784	2.6897
2A11B	0.9140	7.2118	2.2211	1.0672	16.8143	0.3876
	98.7668	239.1958	735.0332	4.6366	20.4615	125.4430
	5.5792	32.5173	70.6477	5.6588	1.3968	4.4751
	2.2401	0.3832	6.1304	0.0000	12.2954	3.5076
OM2A12	1.0008	8.0885	1.6004	1.7821	18.7030	0.4288
	102.6615	181.6096	571.8240	4.9219	17.8165	98.2454
	4.9597	28.1510	58.6644	4.9467	1.3594	3.9973
	2.6827	0.3868	5.0619	1.1579	12.0233	2.5623
OM2B01	0.7357	6.3929	1.6007	1.0247	15.7995	0.3261
	91.7585	217.2302	688.7451	4.3309	17.8072	99.0308
	3.6158	24.5012	56.4518	4.5852	1.0351	3.6266
	2.0548	0.3508	4.6822	0.8319	9.1835	3.2394
OM2B02	0.8514	7.6396	2.3919	0.8572	15.9827	0.3890
	94.1775	166.6239	708.2185	4.3053	17.9649	125.1751
	6.2115	33.4407	68.2801	5.6103	1.4420	3.9189
	1.8961	0.3563	5.3909	1.1608	12.4369	3.4678

OM2B03	0.8682	6.6264	2.0772	1.3514	15.2862	0.3963
	84.3783	193.1561	610.7344	4.2411	16.0122	85.6604
	4.1825	28.9673	62.4793	5.4011	1.1979	4.2424
	1.8831	0.4448	5.2180	1.1057	10.8551	3.2366
OM2B04	0.9425	6.7804	1.8111	1.3195	15.6002	0.4025
	86.8500	185.3833	690.9612	4.4056	17.5755	78.9556
	3.4242	26.2144	53.1383	4.6874	1.3643	4.0339
	2.4554	0.3569	4.9195	0.6312	9.8870	3.1034
OM2B05	0.8445	6.7558	1.8097	1.2554	14.2891	0.3817
	77.9434	175.0231	596.8926	4.0565	16.5840	91.4869
	3.9228	24.3936	53.2488	4.7410	1.1682	4.0096
	1.4964	0.3859	4.5356	0.6769	10.0726	3.0139
OM2B06	0.9099	6.2896	2.2279	1.4202	14.4680	0.3498
	75.6652	201.9553	675.3437	4.1660	17.0679	73.4167
	3.8400	23.9689	51.5966	4.2738	1.0949	3.8952
	2.2674	0.3189	5.1479	0.5532	9.6060	3.1860
OM2B07	1.0555	6.3040	1.9715	1.9942	15.9709	0.3841
	86.9182	166.7814	723.1985	4.1254	15.7452	90.5669
	3.6583	25.6531	56.0621	4.6906	1.0698	4.0964
	1.8299	0.3913	4.9493	0.9491	10.2350	3.4868
OM2B08	0.7451	6.4022	1.7223	1.1738	15.6422	0.3895
	95.2293	212.2795	699.5508	4.3610	16.6696	85.1320
	3.7579	25.6714	53.3485	4.6522	1.0973	3.5881
	1.7789	0.4355	4.5308	0.6132	9.7074	3.2185
OM2B11	0.6293	7.3282	2.1661	0.8503	15.9054	0.4121
	102.2124	202.7903	804.7307	4.4089	18.7059	98.1933
	4.6854	29.4587	56.0125	4.9052	1.2180	3.9687
	1.4884	0.3826	4.7841	0.7590	10.5170	3.4156
OM2B12	0.8561	7.1339	2.1742	0.9954	15.4950	0.3747
	95.4106	182.8371	552.2942	4.4684	16.3141	80.9224
	3.9126	27.4565	59.0120	4.5332	0.9833	3.6683
	2.2336	0.3888	4.8119	0.8091	9.8260	2.9836
2B12B	0.8774	7.6018	2.0516	1.2038	15.1206	0.4030
	95.5530	157.3271	602.6196	4.2338	17.1028	101.6272
	4.7067	24.0075	64.9614	4.7640	1.1489	4.0381
	2.1784	0.3267	4.7839	0.0000	11.1938	3.3341
OM2B13	0.9073	7.3340	2.1682	1.7990	17.0619	0.3866
	102.3489	178.9543	609.1885	4.5767	18.4245	93.8345
	3.4304	24.9189	50.9267	4.8689	1.0088	3.6693
	0.7478	0.4298	4.3039	0.4840	10.4574	3.2295
OM2B14	0.5588	6.6651	1.9486	0.8216	14.1250	0.3532
	85.0149	201.4412	713.5962	4.0123	17.1328	76.8938
	3.9456	25.0428	52.0389	4.5923	0.9782	3.6030
	1.9732	0.3736	3.9521	0.9951	9.5654	3.2274
OM2B15	0.8655	7.9473	2.2103	1.3239	16.2050	0.4305
	105.7227	174.4317	629.9502	4.2454	15.7836	95.2493
	4.8993	25.1035	51.3906	4.7292	0.9241	4.1145
	1.9821	0.4282	4.2488	0.9094	10.3885	3.4220
OM2B16	0.7907	6.6951	1.7906	1.9886	14.4895	0.4029
	80.5542	310.9434	757.8320	3.9898	17.5020	83.9420
	4.1273	25.9327	57.7246	4.8896	1.1414	3.9388
	2.0330	0.2588	5.4156	0.6521	8.7709	3.3655
2B16B	0.8892	6.8589	1.8887	1.6359	13.9175	0.3628
	87.9412	226.1504	713.0793	3.7634	17.4480	75.3447
	3.3725	24.1548	50.3835	4.5778	1.2306	4.6104
	2.2397	0.3558	4.5443	0.0000	8.4209	3.7105
OM2C01	0.5465	8.1094	2.0790	1.0024	15.6794	0.4134
	91.4625	215.7951	778.1575	4.6062	17.3624	104.5228
	4.4120	27.8571	58.7652	4.9822	1.2496	4.3312
	2.3093	0.3512	4.3299	0.0000	10.2251	3.6224

OM2C1B	0.6644	7.2188	2.2550	11.5308	16.8364	0.3846
	120.8114	225.8921	1170.8301	4.8054	20.6088	82.4592
	4.3746	28.7021	62.3550	5.0536	1.0717	4.1469
	2.3545	0.3440	5.2979	0.0000	10.9733	4.5974
OM2C02	0.5740	8.1851	1.8071	1.1625	16.1899	0.3659
	90.0750	238.1294	825.4229	4.5995	19.7992	77.9883
	4.3485	29.3503	67.6645	5.1575	0.9864	4.3511
	2.9849	0.3316	5.3267	0.0000	9.8869	3.7881
OM2C03	0.5076	7.4466	2.1343	1.1261	14.4278	0.3922
	79.1535	190.6351	828.7324	4.0516	15.9986	83.3015
	4.3198	25.6835	51.1964	5.1490	0.9908	4.1642
	2.6679	0.4086	4.9827	0.0000	8.8570	3.8086
OM2C04	0.5610	7.7755	2.2857	1.1785	16.2858	0.3903
	88.1968	216.2412	699.1687	4.6722	19.4524	89.5339
	4.6744	28.4441	54.2976	4.9840	1.2411	3.8364
	1.9499	0.2884	5.0273	0.0000	10.8479	3.4984
OM2C05	0.5845	7.3603	1.8092	0.8083	15.0798	0.3684
	85.5898	213.1105	723.3706	4.3183	17.2771	86.6980
	4.7998	27.2623	56.2089	5.0428	1.0392	4.3487
	1.8369	0.3084	5.1244	0.0000	9.2025	3.4753
OM2C06	0.7915	7.0777	2.2494	0.7039	14.5989	0.3801
	86.2393	186.4045	898.5310	4.3951	19.4759	90.4251
	4.2377	28.3163	62.6754	5.1390	1.1098	3.5832
	2.1052	0.3746	6.0180	0.0000	10.5088	3.8922
OM2C07	0.5624	7.4075	1.9687	0.9946	15.9997	0.3565
	85.3849	224.2589	759.8027	4.6026	18.8208	87.1017
	4.2098	28.6317	62.8270	5.2274	1.0680	3.7342
	2.2915	0.4045	4.4787	0.0000	9.7208	3.5271
OM2C08	0.5873	7.1198	1.7977	1.0578	16.1319	0.3924
	88.1568	246.4966	800.3057	4.6933	19.5316	97.7140
	5.0748	29.0265	59.3940	5.3440	1.1737	4.1924
	2.0454	0.3657	4.3940	0.0000	10.5974	3.9059
OM2C09	0.6049	7.5943	2.0115	0.8004	16.6148	0.3979
	86.9348	226.5016	806.1638	4.8550	20.1800	109.2205
	5.0731	29.4993	61.0116	5.3315	1.1079	4.2879
	3.1121	0.3189	4.9278	0.0000	10.7712	3.7613
OM301	0.3395	6.9091	1.6324	11.1854	19.7491	0.3740
	103.9852	329.6895	825.0430	4.9028	30.4735	88.5444
	8.4278	22.0273	39.7426	3.4747	0.9501	3.8132
	0.0000	0.2579	2.4523	0.0000	7.3654	0.3762
OM302	0.3448	6.8660	1.9617	9.9845	23.3706	0.3452
	118.6668	422.3794	842.7087	5.7618	36.6702	117.4815
	9.3414	24.3422	46.1382	3.8991	1.1258	3.1804
	3.0667	0.3589	3.0666	0.0000	8.1020	1.9496
OM303	0.3263	6.9013	2.3447	10.1874	21.9548	0.3027
	107.6044	386.1057	1041.7871	5.4595	34.9010	124.1910
	8.7416	23.1524	43.8560	3.9007	1.2005	2.7730
	1.7178	0.2658	2.6589	0.0000	8.1606	2.5297
OM304	0.3097	7.0317	2.1323	13.4890	22.7924	0.3709
	103.7910	356.5637	887.5576	5.5310	33.8253	131.7420
	9.4281	29.3516	49.1907	4.9306	1.4356	3.2603
	3.1043	0.4468	2.9134	0.0000	8.8573	2.2231
OM306	0.4846	8.0371	2.3858	5.6834	26.5100	0.4117
	147.1504	515.6128	824.3625	6.1880	38.5807	153.8875
	8.6148	27.9262	54.7048	4.7861	1.1681	3.5902
	1.6006	0.4215	2.9864	0.0000	9.5219	2.3465
OM307	0.3947	7.7195	2.1344	6.7794	23.3602	0.3595
	124.4818	456.6956	822.7915	5.5898	35.0303	139.0778
	7.7879	23.2236	45.0756	4.0136	1.0115	2.8097
	1.8602	0.2004	2.0465	0.0000	8.2975	2.2464

OM37B	0.4208	7.8888	2.9499	7.2366	24.8057	0.3430
	132.3904	436.3950	821.4756	5.9215	38.2053	126.8227
	7.9370	25.0230	57.6265	3.9813	1.1143	4.1091
	2.3882	0.3404	2.8450	0.0000	8.4351	2.9527
OM308	0.4071	8.3397	2.7023	7.2202	24.7032	0.4266
	148.3207	440.7952	683.2002	5.8481	32.9691	157.7415
	9.0021	26.6917	56.7864	4.7288	1.0207	3.5832
	2.5965	0.3311	2.3796	0.0000	10.0285	2.2381
OM309	0.2947	8.9511	2.5592	7.0917	26.0758	0.4039
	158.6525	388.3875	740.6721	6.4575	38.3599	185.0805
	10.5188	31.5430	53.4906	5.0203	0.8391	3.6266
	2.6208	0.3022	3.1325	0.0000	11.2515	2.5919
OM311	0.5003	7.9266	2.1460	7.0250	26.1384	0.4015
	134.4500	603.5205	752.2822	6.3559	41.3836	158.2005
	7.8128	26.9715	43.7323	4.3314	1.0971	2.7660
	2.4880	0.4868	3.0950	0.0000	8.8281	2.0606
OM312	0.4949	8.4193	2.5246	7.6704	25.1212	0.4268
	140.0009	368.3943	755.6914	6.1690	35.7309	159.3558
	9.1952	29.1204	60.2840	4.7829	1.2010	3.8587
	2.6556	0.4142	2.9323	0.0000	9.8386	2.2692
OM312B	0.4092	8.8449	2.8098	7.9100	23.5409	0.4104
	153.0678	455.4016	823.1636	5.6631	42.2276	122.7647
	8.7896	24.5483	47.2601	4.2560	0.8610	3.7664
	1.6499	0.3212	2.3108	0.0000	8.3649	2.4873
OM313	0.5339	8.3853	1.9076	7.4154	25.1615	0.4453
	130.4180	394.7588	816.7849	5.9289	37.6875	152.1598
	8.7793	28.7722	51.8904	4.7615	1.1731	3.6779
	3.3147	0.3274	3.1932	0.0000	10.3961	2.7073
OM314	0.4284	8.1212	2.3611	8.3784	23.6533	0.3741
	125.5725	376.4517	864.4231	5.5115	35.5196	142.7113
	7.6629	27.5296	55.9692	4.4654	1.0770	3.3245
	2.6080	0.3964	2.8166	0.0000	9.5028	2.8673
OM315	0.4846	8.1708	2.5641	6.6029	22.1796	0.3806
	127.8643	354.9023	765.5022	5.2497	34.2189	153.7182
	7.6720	26.2988	54.1048	4.5078	0.9384	3.2962
	2.8448	0.2562	2.9117	0.0000	9.7736	2.7775
OM316	0.4593	8.8320	2.6482	7.6832	24.0279	0.4282
	135.4996	387.4641	823.5608	5.6536	34.4586	131.3347
	8.0425	27.5355	45.3178	4.4663	1.3362	3.2811
	4.1738	0.3357	2.6052	0.0000	10.4798	2.8711
OM317	0.4282	8.0970	2.5945	6.6274	23.1040	0.4349
	137.9659	421.9492	716.0857	5.5995	32.6459	152.7477
	8.0754	26.4898	49.4230	4.5974	1.0610	3.3392
	1.1742	0.3561	2.4323	0.0000	11.1075	2.2366
OM318	0.5517	8.6184	2.3677	6.5533	23.5420	0.4228
	136.4203	379.1267	777.1580	5.6207	36.8496	119.1214
	7.9439	26.4751	55.7089	4.1500	0.9204	3.1729
	3.4481	0.3308	3.0859	0.0000	9.8913	2.6805
OM319	0.5028	7.7125	2.3377	7.2183	23.1264	0.3974
	122.1811	379.9211	822.0732	5.5964	37.7305	151.5393
	9.2355	26.8396	54.8562	4.7116	1.1959	3.4304
	2.0079	0.3707	3.3208	0.0000	10.4318	2.8229
OM320	0.4891	8.7052	2.8079	8.0759	23.5693	0.4385
	134.0913	369.2056	839.1624	5.6610	36.7604	149.5941
	7.3512	27.6980	53.6349	4.6927	1.1192	3.1914
	1.8723	0.5053	2.3931	0.0000	10.2418	3.0704
OM322	0.4137	8.6397	2.8781	8.7045	22.8340	0.4113
	151.0056	371.7549	812.8755	5.6010	33.7721	151.1616
	8.4083	27.6911	50.7654	4.2975	0.8404	3.0600
	2.6473	0.2610	2.7584	0.0000	10.1091	2.6580

OM322B	0.4788	8.2300	3.4416	7.1521	23.6247	0.3985
	134.7339	391.0725	863.7954	5.6228	42.4252	133.0244
	7.0639	26.0165	54.5101	4.0817	0.8066	3.7647
	2.5116	0.2842	2.5846	0.0000	8.9943	3.3293
OM323	0.4990	8.7622	2.7747	7.0882	24.5324	0.4000
	132.9348	394.2361	792.3916	5.7759	38.1346	133.3539
	8.6831	28.6952	53.3757	4.3776	0.9972	3.6360
	2.2140	0.5587	3.3917	0.0000	10.0044	2.8653
OM401	0.3642	8.2801	2.3557	7.7160	26.2635	0.4019
	141.1913	490.1641	813.0259	6.2963	36.7884	134.7066
	8.3800	27.4475	53.9368	4.2306	1.3968	3.8144
	2.3142	0.3531	2.8566	0.9539	9.5730	3.0633
OM402	0.7701	7.2951	1.9852	8.2598	22.2482	0.4153
	118.1941	326.0854	964.9053	5.7090	28.0657	101.8983
	5.6823	29.1481	60.0539	5.1976	1.3614	3.6252
	2.2780	0.3702	3.4222	0.6532	10.0535	3.2906
OM403	0.7475	7.2393	2.4903	8.9321	18.9357	0.4375
	106.6143	282.3145	924.0732	5.3353	32.7952	82.1593
	5.6494	27.7145	51.5490	5.2357	1.4273	4.0403
	2.7503	0.3703	3.8531	0.6042	9.6310	3.5623
OM404	0.7339	8.2354	2.1201	9.1037	21.8628	0.4107
	115.3538	202.5234	1014.9241	5.6616	24.3994	99.8350
	6.5486	31.4706	69.1852	5.5934	1.3121	4.0608
	2.9357	0.3133	4.6602	1.1877	12.1748	3.0938
OM44B	0.7095	8.3099	3.0747	9.0384	20.6194	0.4675
	131.1761	181.4758	888.0435	5.3403	24.7023	108.4065
	5.7706	30.1187	73.1434	5.5758	1.1755	4.0014
	2.7991	0.3963	4.3887	0.0000	11.5813	3.0122
OM405	0.5846	7.3443	2.8928	6.0625	20.9895	0.4091
	116.1141	282.4062	1028.1660	6.0349	31.1856	129.8953
	5.8951	27.0188	59.9634	5.3694	1.4560	3.9387
	1.7373	0.3550	3.7139	0.7129	10.7244	3.2588
OM406	0.3181	7.5768	2.6802	8.5192	23.6392	0.4290
	139.3783	401.0696	931.5994	5.8619	36.5706	127.3998
	8.2475	26.8250	49.0339	4.4390	1.2839	4.3560
	1.6580	0.3696	2.5829	0.4289	9.5347	2.9426
OM407	0.8508	8.1314	2.7436	3.4545	21.4033	0.4970
	127.2212	224.5520	870.7368	5.5235	24.8039	130.2167
	6.8748	31.9927	68.6304	5.7328	1.2325	3.8882
	2.5892	0.4174	5.0510	1.0004	13.6252	3.2922
OM408	0.6886	8.1519	2.8198	5.5307	23.8780	0.4060
	125.3071	304.8577	1045.7300	6.7518	36.0991	114.1783
	5.4591	27.7921	59.8513	5.3621	1.4009	3.7179
	2.9203	0.4578	3.8687	0.9015	11.3942	3.4434
OM409	0.2902	8.2112	3.0077	9.1188	23.9799	0.3833
	134.1882	349.8689	1005.5171	5.9622	32.6368	157.2292
	9.1884	29.8216	52.4569	5.2605	1.2689	4.0101
	2.3161	0.4851	3.0596	0.9775	10.4618	2.8436
OM410	0.2906	7.3045	2.3354	7.7062	22.2045	0.4111
	133.9084	498.1653	759.6909	5.4605	32.0339	114.4449
	9.3812	25.8655	48.4750	4.6306	1.1748	3.8022
	2.1923	0.3362	2.7069	0.9427	9.2094	2.9990
OM5A1	0.6349	8.0078	2.8189	9.4035	19.6676	0.4359
	123.8520	197.9733	911.3457	4.9546	23.3776	120.6254
	5.8385	29.4348	60.1947	5.2911	1.2100	4.4605
	2.0387	0.3115	4.0366	0.0000	10.9873	4.2218
OM5A2	0.4048	7.5207	2.4991	7.6449	24.3648	0.3891
	120.1301	490.0967	834.7639	5.8976	34.4608	139.0244
	7.7503	25.2619	50.1706	4.1496	0.9356	3.4120
	2.2205	0.3810	2.7893	0.0000	8.1467	3.7361

OM5A3	0.3446	7.3260	2.3244	9.0889	23.4647	0.3796
	121.4682	532.4468	895.0349	5.7436	35.0056	135.3377
	7.2232	23.7172	47.2085	4.0307	1.2037	3.5129
	1.9077	0.3577	2.7387	0.0000	8.3439	3.8724
OM5A4	0.3772	7.2083	2.5774	8.5500	21.7913	0.3517
	126.7651	446.8574	1082.5669	5.4256	36.1801	115.4592
	7.6881	23.8821	48.5051	4.0198	1.3104	3.9449
	2.2516	0.3480	2.6741	0.0000	8.0043	4.2146
OM5A5	0.6545	7.3218	2.2087	8.9929	18.1895	0.3914
	117.6183	178.0226	870.3582	4.7681	21.0619	112.4308
	5.8868	27.7085	57.8627	5.2296	1.4726	3.9707
	2.4709	0.3562	3.7778	0.0000	10.2471	3.9844
OM5A6	0.4118	7.2192	2.5287	7.3819	21.7436	0.4481
	143.8234	397.4602	769.7703	4.6916	33.0802	119.3998
	7.2747	22.7986	46.8291	4.1814	1.0627	3.6925
	2.1974	0.3234	2.3660	0.0000	7.9517	3.7507
OM5A6B	0.3842	7.6335	2.9034	8.6367	24.1095	0.3880
	144.9138	416.4512	895.1064	5.3917	36.3866	118.1730
	7.9589	24.8040	50.9189	4.1778	0.9539	3.8450
	1.7170	0.3300	2.6003	0.0000	9.2472	3.5225
OM5A7	0.2972	6.6446	2.2397	9.5554	19.8754	0.3338
	124.5538	336.7905	1341.5371	5.1412	32.4219	108.9631
	6.2875	21.7574	39.5444	3.6452	1.2722	2.7635
	1.8579	0.3224	2.0275	0.0000	7.1272	5.2860
OM5A8	0.3042	6.4999	2.0548	10.4585	22.0363	0.3036
	120.9963	377.0239	1011.7720	5.5073	29.0055	104.3327
	6.4185	22.2772	39.9063	3.8214	1.1907	3.3786
	2.1600	0.3400	2.5706	0.0000	7.4522	4.2438
OM5A9	0.2901	7.0328	2.2376	9.6320	20.8837	0.3696
	126.8755	353.3601	930.0923	5.1730	30.1572	100.1499
	7.0593	23.1329	47.7787	3.8178	0.9688	3.3693
	1.7820	0.3292	2.2153	0.0000	7.7315	3.7368
OM5A10	0.4423	7.3792	2.6600	6.5806	23.7604	0.3406
	134.2043	530.0364	875.4824	5.7118	34.4858	112.0055
	6.9585	23.3769	41.9612	4.0101	0.9361	3.3376
	2.3119	0.3572	2.9124	0.0000	7.7989	4.0502
OM5B1	0.6515	8.2362	2.4478	8.3819	19.1488	0.4298
	127.7923	176.3229	1300.2419	4.8849	22.9327	114.7496
	5.8433	29.6453	61.2918	5.2107	1.3083	4.6432
	2.4624	0.3683	3.6563	0.0000	10.2033	5.2032
OM5B2	0.7554	8.3125	2.6295	9.0361	21.1826	0.4497
	128.2374	199.2354	1297.6931	5.4069	24.1296	126.4242
	5.7507	33.0740	67.8161	5.6837	1.5256	4.3651
	2.8477	0.4197	4.5340	0.0000	11.7035	5.4715
OM5B3	0.6842	8.2570	2.5186	8.6848	19.7158	0.4660
	126.1302	193.5010	1318.4419	5.0926	24.2878	123.6334
	5.4113	31.4494	63.8604	5.2767	1.3538	4.9889
	2.2619	0.3893	3.5126	0.0000	10.4020	5.3319
OM5B4	0.6970	8.2210	2.4837	8.7904	19.9085	0.4175
	129.7310	190.6370	1282.3369	5.1374	23.5126	113.2389
	5.7674	30.9737	63.1951	5.2463	1.3493	4.3656
	2.0225	0.4123	3.6968	0.0000	10.6108	5.4214
OM5B5	0.7102	8.0100	2.4691	8.6706	20.7534	0.4413
	130.0868	203.2440	1178.9810	5.2609	23.3410	120.3535
	6.5469	31.5340	69.2497	5.5829	1.4511	4.7096
	2.5324	0.4275	4.3050	0.0000	11.0557	4.8445
OM5B5B	0.3684	7.9095	2.2384	8.5463	20.1961	0.3929
	129.4766	182.4763	1317.2571	5.1297	23.7396	119.6849
	7.2906	28.6061	62.8950	4.6868	1.1085	4.2073
	3.2700	0.2535	4.2504	0.0000	11.2555	2.7655

OM5B6	0.6373	7.9181	2.3285	8.8050	18.7393	0.4313
	127.7968	172.7120	1147.3401	4.9021	23.2020	107.7041
	4.9688	28.0670	59.0530	4.9422	1.2939	4.2886
	2.0834	0.3171	3.6498	0.0000	9.7330	4.8390
OM5B7	0.6204	7.5208	2.1905	8.6820	18.4234	0.4906
	125.8360	170.2050	998.7646	4.7486	22.7041	107.8803
	5.5772	28.9292	57.8185	5.0713	1.2298	4.6206
	2.1976	0.3995	3.8632	0.0000	10.1092	4.5546
OM5B8	0.6671	8.1947	2.8675	8.3928	18.7104	0.5033
	135.7231	182.5730	1237.2490	4.8245	21.5699	129.4613
	5.8998	28.9283	59.2994	5.5017	1.2672	4.6519
	2.0419	0.3738	3.6978	0.0000	10.4983	5.4324
OM5B9	0.7820	8.0713	2.7031	8.9977	19.6472	0.4695
	127.8486	191.3980	1002.2241	5.0489	20.3841	118.8451
	5.9045	31.2722	64.8017	5.7834	1.3400	4.7672
	2.5851	0.3647	4.1818	0.0000	11.2583	4.8951
OM5B10	0.7942	7.9030	2.3554	7.8305	19.5645	0.4574
	115.8283	189.5985	943.8281	4.8901	20.6502	117.3464
	6.1145	31.6242	62.7290	5.5971	1.4198	4.0129
	2.7874	0.3917	4.3615	0.0000	10.9992	4.4235

Handmade wares from Argos.

AM01	0.3210	7.8237	2.5641	10.3073	22.3243	0.4232
	112.9004	360.4158	1172.4231	6.0067	34.4039	154.1158
	9.7036	25.7308	52.8451	4.6226	1.0220	3.4993
	3.3135	0.4662	2.8871	0.7206	9.7704	4.7396
AM02	0.3091	8.7856	3.4996	8.3351	24.5217	0.4356
	137.7182	355.2966	895.6062	5.9234	39.7363	143.5625
	9.0121	30.0972	53.8609	4.6819	1.2118	3.5366
	1.7920	0.4667	2.7156	0.7989	10.1223	4.0041
AM03	0.2969	7.7565	2.9489	10.5501	20.5223	0.3683
	120.0056	346.6062	1036.2510	4.7275	39.6402	133.9373
	8.8318	27.6219	51.3483	4.5799	1.1700	3.9696
	2.5780	0.3801	3.2735	0.8589	9.8192	4.0923
AM04	0.3108	7.3475	2.8577	10.1318	22.1732	0.3552
	104.4490	449.4446	1037.8589	5.2313	45.5956	113.9797
	8.0703	28.6916	47.3183	4.5165	1.0630	3.4618
	1.5628	0.3154	2.8235	1.1528	8.2119	4.1060
AM05	0.4653	7.0620	2.6632	9.4707	20.8032	0.4256
	120.9790	372.3540	917.2427	4.8796	31.7812	95.3356
	6.6712	24.9444	51.7893	4.5288	0.9616	4.0916
	2.1802	0.2858	3.1565	0.0000	8.3548	3.3192
AM06	0.3185	8.6015	3.0782	8.0172	20.1414	0.4338
	131.6189	265.3203	948.7583	4.9854	30.5987	122.0978
	7.5442	28.0919	53.6395	4.4308	1.1961	4.0741
	2.4256	0.3473	2.7884	0.0000	8.9167	3.2985
AM07	0.2362	8.2803	3.2526	9.7883	28.7085	0.3973
	126.6315	430.3501	1190.8181	7.0455	43.0304	173.7632
	9.2425	28.8124	71.5495	4.8969	1.0239	3.9315
	1.7427	0.2769	2.9849	0.0000	10.7660	3.1131
AM08	0.2524	9.1625	3.3562	6.3708	25.5187	0.4071
	169.9280	602.4316	846.0676	6.1541	38.3010	127.0617
	7.3413	28.6242	54.3385	4.3302	0.9200	4.1696
	2.1882	0.3051	2.4416	0.0000	9.8987	3.0166
AM09	0.3617	7.4646	3.2396	8.0150	24.8288	0.3915
	117.4751	508.8325	1222.6909	6.2305	41.2308	105.3405
	7.4149	27.7672	56.0143	5.0684	1.4750	4.2193
	2.2595	0.3055	2.5383	0.0000	9.8996	3.8012

AM10	0.4057	7.4608	2.9958	9.6955	19.1464	0.4724
	126.6083	317.1787	1110.5620	4.7923	33.8510	105.6018
	5.6784	24.1716	51.3748	4.6403	1.0937	3.9395
	1.8172	0.3501	2.8152	0.0000	8.4886	3.6162
AM11	0.2807	8.4260	3.7963	9.8365	23.4287	0.3995
	144.2080	373.8818	829.9314	5.6463	34.7885	109.6807
	7.1335	26.4161	54.7039	4.4428	1.0257	4.6489
	2.2625	0.4460	2.4746	0.0000	8.7687	2.7888
AM12	0.3909	8.5881	3.5403	7.2964	26.3324	0.5009
	155.8359	426.5669	664.8865	5.7561	35.6049	138.2310
	7.3851	29.6089	50.9132	4.6107	1.0222	4.4356
	2.8243	0.3639	2.9146	0.0000	9.5945	3.1627
AM13	0.3470	5.7862	2.4743	10.6236	18.3365	0.3579
	91.0033	420.1296	916.9565	4.4082	31.3315	91.6070
	6.0760	18.4539	32.1451	3.3550	0.8903	3.4141
	1.6589	0.2325	2.1739	0.0000	5.3443	2.4302
AM14	0.2733	7.7206	3.0726	7.8233	23.7617	0.3465
	136.1000	355.7346	1104.6499	5.5419	44.3470	122.2416
	7.4553	25.8337	50.0665	4.4191	1.0131	3.7534
	1.9610	0.2739	2.6211	0.0000	9.5939	2.9032
AM15	0.9879	8.6752	2.8532	3.2900	19.2366	0.5046
	97.3497	223.0887	786.3916	5.0073	23.9768	86.4616
	5.3766	29.7297	57.6947	5.4948	1.2145	5.1010
	2.5072	0.3647	4.6716	0.0000	10.7475	3.2743
AM16	0.9946	8.3083	2.4906	3.0552	20.0669	0.4949
	103.9411	241.2046	951.5874	5.6025	28.1004	93.1636
	5.1448	29.5912	66.8565	5.4061	1.2933	4.3715
	4.7946	0.3427	4.9937	0.0000	12.6397	3.6230
AM17	0.4091	8.4309	3.0835	6.2989	24.3731	0.4360
	148.4376	427.3611	857.3730	5.8129	37.1141	134.7918
	7.6978	26.3865	53.3666	4.4728	1.0455	4.0225
	2.2125	0.3570	2.8374	0.0000	8.7412	3.1215
AM18	0.2933	8.6830	2.7496	8.7672	23.4068	0.3949
	135.9668	346.9771	774.1255	5.7392	38.4417	144.2677
	8.1225	25.5961	54.8956	4.2582	0.9414	3.1516
	2.1562	0.4112	2.4249	0.0000	9.3148	2.4369
AM19	0.9997	8.7870	3.0956	3.0227	19.8096	0.5456
	106.7195	225.4319	768.7012	5.2454	24.4140	105.2465
	4.4144	26.1803	59.5965	4.9742	1.1786	4.5357
	1.2782	0.3889	4.6936	0.0000	10.6144	3.0682
AM20	0.2664	7.5971	3.3639	11.2046	22.3975	0.3801
	115.3569	323.3640	840.9939	5.6210	30.5606	139.8249
	8.2955	29.2239	66.6938	4.9107	1.0198	3.4825
	2.7372	0.3462	3.0103	0.0000	10.4738	3.5643
AM21	0.4089	6.9660	2.9036	10.2969	21.4701	0.3213
	117.6385	385.3557	711.2415	5.5452	32.9483	116.1226
	7.8675	24.0141	51.2123	3.8704	1.0813	3.1490
	1.9159	0.3737	2.2463	0.0000	8.3761	2.9689
AM22	0.9212	6.9781	2.4921	1.1717	16.4871	0.3860
	90.6274	241.0715	591.7644	4.3412	17.0742	91.4634
	4.7179	27.1722	63.1904	4.7205	1.0383	4.3077
	2.3650	0.2685	5.6686	0.0000	9.8304	3.0022
AM23	0.8837	7.3760	2.8485	10.7738	21.9809	0.4011
	118.6497	353.4233	933.3086	5.7581	29.8117	116.6296
	10.7126	38.2009	54.9524	6.1031	1.2033	3.4826
	2.1244	0.6022	2.1722	0.4544	9.2616	4.0637
AM24	0.3363	9.1049	1.5506	8.1308	26.9603	0.4511
	155.9979	362.4431	1036.5569	6.2264	40.7986	154.4406
	10.6287	25.4477	68.3915	3.9245	1.2959	4.8706
	1.7057	0.2205	3.2777	1.4152	12.1215	4.7919

AM25	0.2881	7.0074	2.3612	11.6221	22.1003	0.3621
	117.0004	404.9302	991.4060	5.2040	34.2952	133.3577
	6.4497	27.3745	46.8637	4.4327	1.2123	3.6830
	2.2623	0.3863	2.2733	0.8577	8.1305	3.8280
AM26	0.2223	8.6604	3.0791	8.5410	24.5902	0.4252
	128.9546	331.5051	879.9573	6.1290	32.4653	164.7770
	10.6714	29.9833	53.1405	4.8700	1.0673	3.8731
	1.5622	0.3792	2.5089	0.9004	10.3727	4.0398
AM27	0.4507	7.6067	2.7977	7.5980	23.8264	0.4633
	139.3558	410.0923	1032.3640	5.8068	36.0624	122.4608
	7.6509	25.5180	52.0808	4.3513	1.1216	3.8443
	2.2712	0.3693	2.7335	0.0000	8.9384	4.4130
AM28	0.8736	7.2978	1.8259	1.0214	8.9851	0.2066
	43.5411	53.3029	159.4275	2.2918	4.9701	69.8986
	4.0540	21.8196	39.5012	3.5662	0.8239	2.9430
	1.4447	0.2603	3.8323	0.0000	8.1326	1.9593
AM29	0.9074	7.5265	1.6638	0.9660	8.9407	0.2030
	51.2104	56.2244	150.0432	2.2988	4.7670	88.3003
	5.0318	22.5375	41.1032	3.5859	0.9796	2.8911
	1.6874	0.3047	4.1456	0.0000	9.0931	1.7892
AM30	0.3175	8.5096	2.8485	7.3726	23.0696	0.3739
	139.1209	356.0227	942.0842	5.8072	33.3387	137.7317
	8.8740	27.1373	49.7787	4.2196	1.3121	3.8812
	2.3626	0.3579	2.5543	0.0000	9.4320	4.1811
AM31	0.3212	6.8248	2.7198	7.2913	21.7964	0.3815
	125.7812	351.3823	1103.8560	5.5615	32.8462	127.8125
	8.1656	25.2162	46.3421	4.2653	1.2633	3.6922
	1.8513	0.2892	2.8692	0.0000	9.1227	4.4995
AM32	0.8614	9.2473	3.3372	4.5668	18.9882	0.4945
	123.5065	214.2753	548.7466	4.4682	23.1296	139.2445
	7.2977	34.8688	67.7469	5.3331	1.1633	4.7088
	2.7524	0.4032	4.9727	0.0000	11.7807	3.7765
AM33	0.4036	7.8861	2.8303	4.8012	20.9266	0.4116
	105.6250	439.2749	1021.7959	5.4129	34.0093	88.1805
	6.0214	22.4003	48.6521	4.0889	1.3858	3.7663
	2.1679	0.3820	2.8234	0.0000	8.9668	4.3542
AM34	0.3485	8.9812	2.9720	7.8105	25.2607	0.4649
	149.4613	388.2720	930.6194	6.2175	36.3628	149.8674
	9.7351	27.1365	52.9924	4.4128	0.9859	3.8602
	2.1199	0.3629	2.8902	0.0000	10.0910	4.2029
AM35	0.2302	7.9280	3.0526	8.5465	23.0275	0.3826
	140.3887	320.1541	872.9014	5.9493	30.8587	142.6601
	9.8258	28.8597	52.3651	4.9754	0.9989	4.3796
	2.1427	0.3698	2.8039	0.0000	10.1428	3.9686
AM36	0.9494	7.9425	1.3499	9.3711	24.1497	0.4094
	143.0761	350.4182	827.2590	5.6930	34.6198	99.5934
	7.8751	26.2740	48.2112	3.9545	0.9921	3.8051
	2.3923	0.3139	2.9045	0.0000	9.4505	3.9661
AM37	0.4209	7.1414	2.4556	7.2689	23.3555	0.3476
	127.6733	646.0850	1335.6140	5.7007	40.1799	112.0647
	6.9244	23.1964	44.9621	3.8414	1.0113	3.0094
	2.1931	0.3573	2.7639	0.0000	8.2260	5.1726
AM38	0.3206	8.2236	2.9480	5.5935	24.8439	0.4317
	143.2422	453.9224	899.1121	6.4033	37.9105	128.9212
	7.8506	26.9313	52.3078	4.5969	1.2253	3.9528
	2.5048	0.3686	2.6760	0.0000	9.8144	3.9427
AM39	0.2911	8.1336	2.7408	8.5518	23.2288	0.3966
	145.1936	383.7473	889.0735	5.9554	35.5837	128.2361
	8.8237	27.2330	54.0024	4.6432	1.2479	3.6028
	2.1794	0.3665	3.0774	0.0000	10.2650	3.9846

AM40	0.2252	8.7374	3.0949	5.0809	25.7717	0.4670
	146.8455	427.4397	620.6426	5.9478	32.0654	148.4595
	9.7391	26.1530	51.5733	4.1485	0.9524	3.5772
	1.9049	0.4231	3.0496	0.0000	10.5399	3.2364
AM41	0.3645	8.1952	2.9082	6.4839	24.3578	0.4130
	135.7350	368.8345	787.3357	6.0552	35.7707	137.9575
	9.8281	28.5718	57.7146	4.5231	1.0366	3.5264
	2.0756	0.3793	2.8035	0.0000	10.5482	3.7262
AM42	0.3289	8.2462	2.8990	7.9222	23.8823	0.4157
	140.9995	377.8215	970.0452	5.3690	37.0120	127.8271
	8.9910	26.6275	51.0634	4.0729	1.0524	3.4177
	1.8461	0.3189	2.6630	0.0000	8.9864	4.2733
AM43	0.4517	8.2108	2.7851	7.6139	22.3802	0.4394
	137.7883	385.5591	1055.5410	5.5192	35.1487	110.9336
	7.0148	27.0592	51.3709	4.5268	1.0356	4.3595
	2.7107	0.3319	3.5420	0.0000	9.3845	4.4442
AM44	0.7033	9.3224	2.4691	0.5401	19.9495	0.5699
	140.4102	233.3079	542.7913	3.5946	69.9327	139.2599
	7.4021	52.6121	107.3662	9.0438	1.7014	6.3031
	3.4506	0.5749	6.3666	0.0000	15.8307	3.6986
AM45	0.3526	8.7118	2.9739	9.1256	22.9510	0.4125
	155.1108	329.9050	1026.3560	5.1342	33.2701	150.1534
	8.8256	30.2508	51.5733	4.8909	1.1147	4.0862
	2.4608	0.4177	2.6048	0.0000	9.9835	4.6413
AM46	0.4471	8.2646	2.7296	7.1223	23.4179	0.4677
	149.1378	386.5681	698.6733	5.1959	30.5853	128.0781
	8.4342	28.9038	53.6178	4.7685	0.8514	4.2078
	2.3161	0.4125	2.7947	0.0000	9.2419	3.9039
AM47	0.2627	7.8552	2.7785	7.1504	22.1929	0.3740
	136.4069	332.7957	835.9980	5.3504	35.7037	124.1803
	7.7746	25.3756	42.9841	4.2819	0.9953	3.9012
	2.5222	0.3835	2.0901	0.0000	8.4972	3.7758
AM48	0.2783	7.2188	2.2550	11.5308	19.6638	0.3846
	120.8114	346.5583	1170.8301	4.8604	32.6005	96.2088
	6.8797	26.4240	46.7517	4.3680	1.0413	4.1469
	2.0172	0.3396	2.6463	0.0000	8.0088	4.5974
AM49	0.3921	7.7495	2.5038	6.2735	22.5232	0.3726
	131.2492	337.4673	801.5481	5.9632	35.1881	155.6577
	7.8116	25.1468	49.5815	4.0166	1.3111	3.0658
	2.8593	0.1107	2.8280	0.0000	10.0134	2.4712
AM50	0.3190	8.1924	2.9959	7.6951	23.8828	0.3958
	139.9818	372.8064	1175.2810	6.0674	36.3107	145.6956
	8.1113	29.9051	54.1033	4.6049	1.0297	3.2600
	1.2974	0.4717	3.4776	0.6717	10.5367	4.3679
AM51	0.3381	8.1631	2.8031	7.4272	22.3875	0.4347
	139.9211	378.7393	1150.2581	5.8097	35.2795	138.2564
	8.4763	26.0195	50.3614	4.5699	1.0991	3.7569
	2.0460	0.3941	3.0547	0.0000	9.9024	4.4752
AM52	0.6854	7.7748	2.4590	7.2865	22.6281	0.3638
	124.8768	352.0073	790.9460	5.5017	33.7255	150.2848
	7.2983	31.2769	53.4306	5.4960	1.0137	3.2148
	2.0265	0.3594	2.7429	0.0000	8.4368	2.5861
AM53	0.3638	8.1949	2.6204	7.7379	22.1994	0.4287
	134.0936	356.9734	806.2808	5.2953	32.4969	131.3849
	8.1713	24.5831	58.6374	4.2943	0.8963	3.4896
	1.8242	0.3993	2.4445	0.4892	9.6593	3.8026
AM54	0.3965	8.5806	2.9124	7.3643	23.9136	0.4366
	141.5532	357.7593	774.1504	5.7791	31.3823	126.6807
	8.7697	26.5183	57.1535	4.3954	1.2908	3.6070
	2.1250	0.3529	2.8221	0.0000	9.9135	3.8573

Handmade wares from Corinth.

NTH03	0.6796	8.2651	3.1673	7.2548	21.6961	0.5370
	122.4928	232.2348	835.4768	5.8201	26.5856	142.0855
	8.9716	32.2266	62.8541	5.3440	1.2364	4.5652
	2.3543	0.4027	3.4980	0.8375	10.9528	4.9126
NTH05	1.2953	8.2945	1.3931	11.3547	24.2429	0.4810
	151.5363	293.7917	1008.6431	6.3791	33.4384	144.8369
	11.0255	32.8747	63.4790	5.3717	1.1553	3.7103
	2.4303	0.3981	3.4259	0.9755	11.6484	3.7964
NTH07	1.1091	8.1504	2.0838	12.7112	22.5434	0.4685
	145.0468	278.8257	659.7812	6.0190	31.0171	179.0667
	10.4459	30.0952	53.4384	5.1264	1.1478	3.6755
	2.5703	0.3702	3.4214	0.7572	10.9960	4.1886
NTH09	0.4806	8.4633	3.1087	9.9433	23.7945	0.4849
	147.5172	250.7495	800.6892	6.3108	27.5296	150.7255
	9.3846	35.8146	67.7949	5.9967	1.2974	4.2869
	2.4045	0.4767	3.5664	0.9290	11.7346	4.3733
NTH10	0.4914	8.4898	3.6122	9.4901	22.9254	0.5019
	136.5862	283.6365	713.2996	5.7808	29.7314	156.4301
	9.3135	32.8024	64.4897	5.5018	1.1244	4.2306
	2.5571	0.4153	3.2245	1.4081	10.8715	3.3054
NTH11	0.5834	8.0162	3.3464	9.5081	20.6167	0.4510
	126.0799	283.7441	827.4016	5.6263	27.0544	133.7131
	7.7532	29.3938	57.7582	4.9261	1.1317	3.8501
	1.7762	0.3392	3.3865	1.0553	10.2395	4.0646
NTH12	0.4716	8.0283	3.2468	11.7359	21.4141	0.4470
	144.7165	235.7817	1034.4360	5.7433	26.5858	131.5993
	9.9205	31.9736	60.0711	5.1877	1.2116	4.0926
	2.5092	0.3421	3.3080	0.5400	10.9700	4.4155

APPENDIX 2:

SAMPLE DESCRIPTIONS

Sample Descriptions.

Introduction.

The following pages contain descriptions of all the sherds sampled during the present study. For the majority of the sherds the sherd catalogue number and the sample number used during analysis are identical, bar initial letter which identifies the site. However in some cases the sherd number was too large and an alternative number was assigned. In these cases the sample column relates to the name used during analysis, and the sherd column is the archaeological catalogue number.

List of Abbreviations.

AM: Argive Monochrome
ARG: Argive
ARG GEO: Argive Geometric
BEO: Boeotian
BF: Black-Figure
BG: Black Glaze
blk: black
BS: body sherd
bwn: brown
BYZT: Byzantine
CAMP: Campanian
CL: Classical
COR: Corinthian
crm: cream
dk: dark
drill: sampled by drilling
EPCOR: Early Protocorinthian
Frag: Fragment
Geodec: Geometric decoration
grn: green
horiz: horizontal
HW: Handmade ware
imp: import
lge: large
loc: local
met: metallic
ple: purple
sml: small
SP-like: similar to the Spartan groups
thk: thick
typ: typical
vert: vertical

Akraiphnion.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. All Black Glaze sherds, catalogue numbers 1991/20-36.

Sherd.	DESCRIPTION.	Analysis Results.
AK20	Red Ware Kantharos/Kylix	OUTLIER
AK21	Grey body frag	EUBOEAN
AK23	Base of pot	EUBOEAN
AK24	wall with handle	EUBOEAN
AK25	BG Handle	EUBOEAN
AK26	Wall with Handle	SITE GROUP
AK27	Body Frag with Pattern	SITE GROUP
AK28	Base frag	SITE GROUP
AK29	Base frag	OUTLIER
AK30	BG body frag	SITE GROUP
AK31	BG body frag	SITE GROUP
AK32	Handle with deposits	SITE GROUP
AK33	Base frag	SITE GROUP
AK34	Body frag	SITE GROUP
AK35	Body frag	SITE GROUP
AK36	Kantharos/Kypellon local?	OUTLIER

Argos.

All sherds were selected by Dr.A.J.N.W.Prag at the Museum of Classical Archaeology, Cambridge.

Sherd	Description	Analysis Results
AR3	Rim AG Krater good quality geodec out	ARG GEO
AR4	Rim AG plate zigzag decout pale in (drill)	ARG GEO
AR5	Rim AG plate linear dec cream in (drill)	ARG GEO

Argos Black Glaze.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. Sampled, by drilling, by J.Tomlinson and N.Burton for third year projects. Irrad by J.Scott 1990/1.

Sample	Sherd	Description.	Results.
ARG1	IA	BASIN RIM POOR FLAKY GLAZE BWN CLAY	ARGOS
ARG2	IB	Large Basin rim bwn clay (drill)	ARGOS
ARG3	32	RIM CASSEROLE/LEKANE DULL BWN GLAZE	CORINTHIAN
ARG4	33	LAMP DULL PLE GLAZE BWN CLAY V.HARD	CORINTHIAN
ARG5	5	SHALLOW BASIN PURPLE/BWN DULL GLAZE	ARGOS
ARG6	2	Basin rim dull ple/bwn in/rim	ARGOS
ARG7	3	Krater bwn clay BG gritty	SP-like
ARG8	4	Krater rim dull BG in/rim Decorated with white dots/zigzags	ARGOS
ARG9	34	Dish/Bowl rim dull BG v.hard	ARGOS
ARG10	10	BG Rim lipless shallow bowl grooves on wall	SP-like
ARG11	5	Rim of bowl hard bwn clay	SP-like
ARG12	35	Vase body frag similar to 11	ATHENIAN
ARG13	36	MOUTH LEKYTHOS MET BG HARD BWN CLAY	ARGOS
ARG14	6	Dish rim dull BG bwn clay	ARGOS
ARG15	15	Plate rim semi glazed bwn in extending out	ARGOS
ARG16	37	PLATE BROAD RIM 1/2BG dull out unglazed	ARGOS
ARG17	38	BG Wall/Broad rim dish pink clay	ARGOS
ARG18	7	BASE BOWL 1/2BG IN MISFIRED GREY OUT	SP-like
ARG19	8	Rim krater hard gritty bwn clay met BG	ARGOS
ARG20	20	Handle of Oinochoe maetallic BG	ATHENIAN

Argos Handmade ware.

All selected by Dr.N.Kourou at the University of Athens.

Sherd.	Description.	Results.
AM01-2	Argive Monochrome BS hard tan well levigated clay, pale brown slip	ARGIVE HW
AM03-4	Argive Monochrome BS hard tan well levigated clay, pink slip	"
AM05-12	Argive Monochrome BS fine hard fired ware no grits, pink slip	"
AM13	"	OUTLIER
AM14	Handle of an Argive Monochrome vase grey clay red/yellow slip	ARGIVE HW
AM15	"	OUTLIER
AM16,19	Argive Monochrome soft bwn clay l.bwn slip	OUTLIER
AM22	"	OM2
AM17-21	"	ARGIVE HW
AM23	Argive HW BS buff yellow clay incised surface fired hard	CORINTHIAN
AM24	Argive HW BS bwn gritty clay white slip	"
AM25,26	Argive HW white coarse gritty clay	ARGIVE HW
AM27	Argive Monochrome, (AM), BS pink clay, pink/white slip well levigated clay	ARGIVE HW
AM28,29	AM of Bucchero type vdark clay no grits	OUTLIER
AM30,31	AM BS red yellow clay pink slip sml grits	ARGIVE HW
AM32	Argive HW vase semifine soft clay no grits red/yellow clay smooth surfaced	"
AM33	Argive HW coarse pink gritty fabric	"
AM34	Argive HW coarse gritty whitish fabric	"
AM35-43	Argive HW coarse gritty pale bwn fabric	"
AM44	Argive HW pink grey clay sml grits incised surface	"

Argive Heraeum.

All sherds were selected by Dr.D.Williams at the British Museum, London from BOX 1912 6.26.

Sherd.	Description.	Results.
BM76	Skyphoid krater rim, white grits geodec	Argive Geometric
BM83	Krater wall fine white grits dec, typ arg	Argive Geometric
BM90	Skyphoid krater rim vhard bwn clay + white grits good BG + geodec out	Argive Geometric
BM93	Krater BS hard bwn clay, H_2O birds out	Argive Geometric
BM95	BS grn gritty clay, Cor? geodec typ arg	Argive Geometric
BM107	Neck of krater dark grits horiz zigzags out typical argive	Argive Geometric
BM111	Krater BS hard gritty clay geodec out, untypical met glaze, but probably arg	Argive Geometric
BM115	Krater BS geodec similar to BM93	Argive Geometric
BM118	Foot of lge tripod krater hard coarse clay grits prob HW, unglazed in H_2O birds out	Argive Geometric
BM122	Krater BS greenish gritty clay horiz waves + wheels out arg?	Argive Geometric
BM239	Krater BS gritty clay orientalising purple edge + white on dull BG 6th-7th BC	Argive Geometric
BM241	Foot of amphora oriental cream band on purple/red 6th BC	Argive Geometric

Argive Heraeum.

All sherds were selected by Dr.A.J.N.W.Prag at the Museum of Classical Archaeology, Cambridge.

Sherd.	Description.	Results.
AH2	BS AG Krater thin walls skyphoid? bwn glaze out (drill)	Argive Geometric
AH3	Thick krater wall grits met bwn glaze linear pattern out (drill)	Argive Geometric

Asine.

All samples were selected by Mrs.Y.Backe-Forsberg at Uppsala University, Uppsala, Sweden. All sherds from the Asine collection excavated at Asine in 1926, (from 2 areas the Lower town and the Acropolis). Samples range from Late eometric, Archaic to BG Classical/Hellenistic.

Sample	Sherd	Description.	Results
UP01	1079:1	rim pendant 1/2circle skyphos import/local	ARG GEO
UP02	1822	Rim skyphos/cup import/local	ARG GEO
UP03	1855:4	Rim large bowl/Krater (drill)	Asine Gp 1
UP04	1856:1	BS of Skyphos (local??)	Asine Gp 1
UP05	1856:4	Handle of cup (local??) (drill)	ARG GEO
UP06	2656:1	Rim of large bowl	ARG GEO
UP07	3714	Rim skyphos bird motif (local?)	Asine Gp 1
UP08	5330:1	Rim of Krater	ATHENIAN
UP09	1211:1	BS Cup/Bowl (COR LGEO??)	Corinthian
UP10	1211:2	Rim Cup/Bowl (COR LGEO?)	Corinthian
UP11	1271	Frag of lid? Black-Figure ware	ATHENIAN
UP12	1477:8	Base of skyphos (local??)	Corinthian
UP13	1494:1	Handle of column Krater (drill)	Corinthian
UP14	1494:3	Rim of bowl (COR)	Corinthian
UP15	2620	Rim of bowl/cup? (local?)	Asine Gp 1
UP16	3783	Rim of skyphos, Black-Figure ware	ATHENIAN
UP17	4026	Rim cup/bowl (CORSUBGEO/LOC?)	Corinthian
UP18	5513	BS Kylix/flower band cup	ATHENIAN
UP19	5548	Handle Column Krater Blk-Figure (drill)	ATHENIAN
UP20	1477:3	BG handle krateriskos CL?	ARGOS
UP21	1477:7	BG flat handle lekane CL?	ATHENIAN
UP22	1500:7	BG base/wall of skyphos CL	ARGOS
UP23	3714	Rim/neck roundmouthed globular oinochoe (CL/COR?)	Corinthian
UP24	4286:3	BG Twisted handle Amphora CL? (drill)	Asine Gp 1

UP25	4289:1	Base of phiale with knob CL?	ARGOS
UP26	4289:9	Frag of lid CL (drill)	ARGOS
UP27	5513:3	Base/wall of Skyphos CL?	ARGOS
UP28	5517	Base/wall skphos narrow rays on lower body (attic?)	ATHENIAN
UP29	5552	Base/wall of mug? CL	SP-like
UP30	1500:8	BG Rim jar/jug CL?	ARGOS
UP31	1225:2	BG Amphora handle CL/HE drill	ARGOS
UP32	1225:4	half of miniature bowl CL/H	ARGOS
UP33	1486:4	BG Pyxis lid CL/HE drill	ARGOS
UP34	1500:10	BG rim skyphos west slope ware attic?	Asine Gp 1
UP35	4054:2	BS bowl west slope ware attic?	ARGOS
UP36	4154:2	" Hard glaze	ARGOS
UP37	4285:1	Oinochoe BG BS CL/HE Hard clay/glaze	OUTLIER
UP38	4285:3	BG Base/wall Kantharos H?	ARGOS
UP39	4286:2	BG HANDLE KANTHAROS H?	OUTLIER
UP40	4289:2	Jug base BG in red top out CL/H?	Asine Gp 1
UP51	1500:1	BG handle skyphos H?	ARGOS

Asine.

All sherds were selected by Dr.A.J.N.W.Prag at the Museum of Classical Archaeology, Cambridge.

Sherd.	Description.	Results.
AS20	BS closed shape krater wheelmarks in, concentric circles out BG on tan clay GA	Argive Geometric
AS21	BS of krater plain in geodec out gritty	Argive Geometric
AS22	BS krater red/orange glaze geodec out LG	Argive Geometric
AS23	BS krater streaky BG hatched zigzags out (drill) LG	Argive Geometric
AS24	Rim krater hard bwn clay BG geodec LG	Argive Geometric
AS25	Lge krater handle coarse bwn clay geodec inclusions (drill)	Argive Geometric

Athens.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. Sampled, by drilling, by J.Tomlinson 1988 for third year project. Irrad by J.Scott 1990/1.

Sherd.	Description.	Results
AG01	BG Body frag bwn clay	ATHENIAN
AG02-4	no description available	"
AG05	BG Body frag bwn clay	ATHENIAN
AG06	Rim small bowl BG out red in	ATHENIAN
AG07	no description avaiable	ATHENIAN
AG08	BG Base of skyphos	ATHENIAN
AG09	BG Rim of skyphos	ATHENIAN
AG10-11	BG Base of skyphos	ATHENIAN
AG12-14	BG body frag	ATHENIAN
AG15	BG Body frag grey clay	ATHENIAN
AG16-19	BG body frag	ATHENIAN
AG20	BG BS bwn very hard clay	OUTLIER
AG21	BG body frag of skyphos	ATHENIAN
AG22	BG BS lamp blk veins in the clay	OUTLIER
AG23-26	BG body frag	ATHENIAN
AG27	no description available	ATHENIAN
AG28	Lamp nozzle	ATHENIAN
AG29	no description available	ATHENIAN
AG30	Miniature of lekythos	OUTLIER
AG31	Lekythos mouth	ATHENIAN
AG32	Base of stemless cup	"
AG33	BS Lamp	OUTLIER
AG34-39	BG body frag	ATHENIAN
AG40	Lid of pyxis	"

AG41	Small BG body frag	OUTLIER
AG42	no description available	ATHENIAN
AG43-44	BS of lamp	ATHENIAN
AG45	Brown glaze body frag	ATHENIAN

Berbati.

Selected by Arto Peuttiwen from the Swedish Excavations collection at Naplion. Sampled at the Naplion storerooms. Three periods of BG Classical + Hellenistic,(mixed up) and Archaic.

Archaic.

Sample	Sherd	Description.	Results.
BA01	120/1	BS BG+bwn stripes+undercoat AG	Argive Geometric
BA02	120/20	TAN BODY BG STRIPES AG	CORINTHIAN
BA03	999/3	Pale tan thk BS of krater drilled under handle joint COR	CORINTHIAN
BA04	989/2	Pale tan thk BS shallow bowl (COR) impressed toungues with border	CORINTHIAN
BA06	137/15	Kotyle base geo dec circles on underside of base PCOR	CORINTHIAN
BA07	137/14	BG RIM	ARGOS
BA08	987/9	BS bowl BG in pink/bg out figure dec	OUTLIER
BA10	130/-	BS BG in TAN/RED/BG Stripes	CORINTHIAN
BA11	130/32	BS TAN IN BG/RED STRIPES AG	CORINTHIAN
BA12	130/14	Skyphos Rim BG in linear dec out	Argive Geometric
BA13	1017/13	BS Tan IN Brown glaze/dec out	CORINTHIAN
BA14	1017/6	Thk Krater BS Tan clay WORN BG large tongues out PCOR	Argive Geometric
BA15	538/182	Archaic Bowl Base Green clay circular pattern on base COR	OUTLIER
BA16	538/112	BG Rim archaic Kantharos ARG	Argive Geometric
BA17	538/138	Archaic Kantharos base BG ARG?	CORINTHIAN
BA18	538/156	Base Archaic Cup bwn glaze ARG	Argive Geometric
BA19	538/183	Base mini cup white fabric dull bwn glaze in Archaic.	CORINTHIAN

Classical + Hellenistic.

Sample	Sherd	Description.	Results.
B02	889/10	Tan BS Indented Lines drilled	ARGOS
B03	889/15	Skyphos BG Restristed base (drilled)	ARGOS
B05	875/5	Torus Base L SKYPHOS THK BG (drill)	ARGOS
B06	875/3	High flaring amphora base white slip in bwn drilled	OUTLIER
B07	875/11	Outturned rim bowl BG on rim pink/grey slip drilled 1st BC	ARGOS
B08	875/9	Lamp Base BG Thk out thin in 3rd BC	ARGOS
B09	875/4	Lowring bowl base RG dipped 3rdBC	ARGOS
B10	875/1	Ring bowl/saucer base thk in mid BG in bwn glaze dipped out 3rd BC	ARGOS
B11	875/7	Base COR Skyphos BG in figures out v hard pale bwn clay drilled	CORINTHIAN
B12	2002/5	Thk tan lekane rim lime/mica grits slipped pink drilled	CORINTHIAN
B13	2002/4	Rim column krater bwn glaze porous clay	SP-like
B14	2002/1	Lge bowl bwn glaze broad protruding rim some lime lat 5th BC	ARGOS
B15	2002/7	Bobbin angular type white clay 5thBC	CORINTHIAN
B16	1042/3	Overhang rim martar lime/mica slipped	ARGOS
B17	1042/2	Ring base sml bowl BG 2 feet lime out dipped in BG to foot	ARGOS
B18	1042/1	Highring base shlw bowl flakey dull BG	ARGOS
B19	747/2	Low ring foot kantharos BG/red slip	ARGOS
B20	747/6	BODY BG OUT INGRAVED LINES	ARGOS
B21	921/4	Torus base lge skyphos greyish misfired? L5thBC	ARGOS
B26	930/13	Low ring base/wall salt cellar shiny BG misfired brown L5thBC	ARGOS
B27	930/6	Rim/shoulder of lebes bwn out tan in grooves close to lip E.Hell drill	Argive Geometric
B28	935/13	overhanging ribbed rim louterion pink clay lime/mica grits 5thBC	CORINTHIAN
B29	553/32	Round rim sml lekane red slip lime	Argive Geometric
B30	533/26	Round rim sml lekane lime grits	Argive Geometric

B31	533/22	Everted rim bowl vhard orange clay lime/mica drilled 3rd/2ndBC	ARGOS
B32	894/9	Ring base bowl/plate BG in	ARGOS
B33	894/3	Flanged rim covered bowl BG out bwn in drilled handle joint	ARGOS
B34	894/2	Incurve Rim Shallowbowl shiny BG	SP-like
B35	153/-	Base of reliet bowl thk BG rosettes surround acanthus leaf 2nd Hell	ARGOS
B36	879/3	BG RIM	ARGOS
B37	879/10	Base Skyphos matt BG mifired in 4th	CORINTHIAN
B38	879/4	FLAT RIM 1 Handled Worn BG	ARGOS
B39	846/60	Moulded Flat Base Decanter/Jug semi lustrous BG out plain in	ARGOS
B40	846/59	Low Torous Foot Stemless Cup BG	ARGOS
B41	848/3	Moulded ring base walled bowl greyish BG 4th/3rdBC	CORINTHIAN
B42	843/33	Incurving rim lge bowl red glaze out	ARGOS

Corinth Handmade ware.

All selected by Dr.N.Kourou at the University of Athens. All samples of Corinthian Handmade ware vases of the Argive Monochrome type.

Sherd.	Description.	Results.
NTH3	Corinthian HW BS fine hard fired fabric well levigated without grit smoothed surface red/yellow clay	CORINTHIAN
NTH5-12	As above, but a very pale brown fabric	"

Corinth.

All selected by Dr.A.J.N.W.Prag at the Museum of Classical Archaeology, Cambridge. Samples are all thought to be Corinthian. All excavated by the American School of Classical Studies, Athens in 1948.

Sherd.	Description.	Analysis Results
CO18	Body sherd of animal,(Goat leg) style kotyle with blob rosettes. E/MCor Drill	CORINTHIAN
CO41	Foot/wall of vase,(Kotyle). exterior: purple on BG rays and bands	CORINTHIAN
CO43	Kotyle cream clay with dull BG and crude figure drawing. Ripe/LCor	CORINTHIAN
CO46	Kotyle grn clay dull bwn Glaze bands drill	CORINTHIAN
CO59	Rim/Handle Lekanis cream some grits shiny BG in streaky out. COR	CORINTHIAN
CO66	Stemless cup/deep kotyle gream clay horizontal handle. 4th BC Drilled	CORINTHIAN
CO86	lower body of Globular aryballos pale clay horiz bands of dots on belly. Drilled	CORINTHIAN
CO90	Rim/Wall ribbed thick plate cream bands purple plate. Drilled	CORINTHIAN
CO93	Body of Kothon pale clay purple on BG double dots decoration out.	CORINTHIAN
CO96	Body of oinochoe pale clay out, part of wing with added purple. Drilled.	CORINTHIAN
CO100	Body of oinochoe pale clay BG out dec: scale pattern between horis lines. Drilled	CORINTHIAN
CO102	Shoulder of oinochoe incised rays purple/ white on BG, horiz lines.	CORINTHIAN
CO107	Body of oinochoe green clay, worn dec: tongues,figures,lines	CORINTHIAN
CO109	Body of oinochoe gream clay blob rosettes banding white/purple on BG	CORINTHIAN
CO111	Near base of oinochoe good pale brown fabric, dec large rays. Drilled	CORINTHIAN
CO112	Lower foot/wall of oinochoe pale bwn clay	CORINTHIAN

Sherd.	Description.	Analysis Results
C0136	Foot/wall miniature bowl vpale clay dull BG in + most of out.	CORINTHIAN
CO139	Base mini bowl semi-glazed dull BG raised disc foot. Drilled COR	(drilled) Corinthian
CO140	Ungalzed mini bowl green clay unglazed.	(drilled) Corinthian
CO142	Fluted edgr mini bowl dull BG pale clay.	(drilled) Corinthian

Corinth.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. Sampled, by drilling, by J.Tomlinson and B.J.Colston for third year projects. Irrad by J.Scott 1990/1.

Sherd.	Description.	Results.
COR17	one-handled dish	CORINTHIAN
COR18	one handled small deep plate	CORINTHIAN
COR19	Fish plate	CORINTHIAN
COR20	Large saucer (dish/plate)	CORINTHIAN
COR21	Saucer good quality BG	CORINTHIAN
COR22	Large saucer	CORINTHIAN
COR23,24	Large low echinoid?? bowl	CORINTHIAN
COR34	Small echinoid bowl (drill)	CORINTHIAN

Chalkis Geometric.

All selected and sampled by Dr.R.E.Jones while at the BSA. Protogeometric and geometric samples from the Chalkis museum thought to all be local.

Sherd.	Description.	Results.
CH01	Pendant 1/2circle skyphos	OUTLIER
CH02	White slip skyphos handle	EUBOEA
CH03	White slip skyphos	EUBOEA
CH04	Skyphos handle grits	OUTLIER
CH05	Skyphos handle	EUBOEA
CH06	Skyphos krater	EUBOEA
CH08	no description available	EUBOEA
CH11	wall/handle of skyphos	EUBOEA
CH12	White slip skyphos	EUBOEA
CH13	Thick body frag	OUTLIER
CH14-16	"	EUBOEA
CH18	Skyphoid krater	EUBOEA
CH20	Skyphos base	EUBOEA
CH21	Goblet base	EUBOEA
CH22-25	Skyphos base	EUBOEA
CH26,27	Top/handle skyphos	EUBOEA
CH29,30	Body/Pendant semi circle	EUBOEA
CH31	no Description available	EUBOEA
CH32	skyphos frag with metopes	EUBOEA
CH33-38	no description available	EUBOEA
CH39	Large Krater	EUBOEA
CH41	Whole small toe foil oinochoe	EUBOEA
CH43	small bowl (drill)	EUBOEA
CH44	amphoriskos with semi circles	EUBOEA
CH45	Body frag	EUBOEA

Chalkis.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. All thought to be local.

Sherd.	Description.	Results.
C01-2	no description available	EUBOEA
C03	BG Closed shape wheelmarked (LC/H)	EUBOEA
C04	BG Open shape hard clay (red-bwn edge)	ATHENIAN
C05	BG Wall/raised base (LA/C)	EUBOEA
C6A-B	no description available	OUTLIER
C41	Rim/Handle BG Cup red clay bluish galze thin fabric possibly Attic	ATHENIAN
C42	Closed shape base worn BG orange clay	EUBOEA
C43	BG BS Cup pink/red clay	EUBOEA
C44	BG base skyphos fine bwn clay	EUBOEA
C45	BG base stemless cup bwn clay	ATHENIAN
C46	BG open shape cup dull bwn glaze	ATHENIAN
C47	BG base stemless cup bwn clay	OUTLIER
C48	BG Rim Cup/Skyphos bwn clay	EUBOEA
C49	BG Shallow open cup grey clay	EUBOEA
C50	BG Open cup very fine bwn clay	EUBOEA
C51	BG Wall skyphos metallic BG	EUBOEA
C52	Worn BG rim of cup fine bwn clay	EUBOEA
C53	Handle/rim BG cup fine bwn clay	EUBOEA
C54	BG Rim shallow bowl	EUBOEA
C55	Handle Kantharos BG Hard Red Clay	EUBOEA
C56	Open shape cup BG base hard grey clay overfired??	ATHENIAN

Eretria.

All selected Dr.A.J.N.W.Prag at the Manchester Museum.

Sherd.	Description.	Results.
E01	BG body frag	EUBOEA
E02	BG body frag in tan clay out	EUBOEA
E03	BG body frag	EUBOEA
E04	BG base, bottom unglazed	EUBOEA
E05	BG body frag	EUBOEA
E06,10-12	"	OUTLIER
E07-9,13-18	"	EUBOEA
E19	Grey glaze rouletted dish dark grey clay	"
E20	Thick BG tan clay body frag	"

Lachish.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. All thought to be Attic except 3 (LA23-5) Corinthian decorated wares.

Sherd.	Description.	Results.
LA01-17	BG body sherd	ATHENIAN
LA18,19	BG rim sherd	ATHENIAN
LA20-22	"	OUTLIER
LA23-25	Decorated BS	CORINTHIAN
LA26-30	BG handle sherd	ATHENIAN

Elis.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. Sampled, by drilling, by J.Tomlinson 1988 for third year project. Irrad by J.Scott 1990/1.

Sample	Sherd	Description.	Results.
ELI01	51	Base tan clay with deposits BG out	ELIS
ELI02	52	Base tan clay in bwn glaze out	ELIS
ELI03	53	BASE BOWL RIBBED IN CIRCULAR DEC OUT	ELIS
ELI04	54	BS bwn undercoat worn BG engraved ribbing out	ELIS
ELI05	55	BASE GREY CLAY UNGLAZED NOT CLAY OF BG	ELIS
ELI06	56	Neck BG out tan clay in	ELIS
ELI07	57	BG BASE PLATE ENGRAVED CIRCLES IN MID	ELIS
ELI08	58	Base BG tan clay in greyish glaze out	ELIS
ELI09	59	Tan clay BG body frag	ELIS
ELI10	60	Base red undercoat BG with deposits	ELIS
ELI11	61	BG Base of plate with deposits	ELIS
ELI12	62	BG Body frag	ELIS
ELI13	63	BASE/WALL TAN BANDS OUT BWN/BG IN	ELIS
ELI14	64	BS bwnish glaze out tan clay in	ELIS
ELI15	65	Base BG plate like ELI07	ELIS
ELI16	66	BG body slight ribbbing out	ELIS
ELI17	67	BG body frag bwn clay	ELIS
ELI18	68	BG handle with deposits	ELIS
ELI19	69	BG body frag tan clay	ELIS
ELI20	70	Curved BG body frag	ELIS

Halieis

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. Sampled, by drilling, by J.Tomlinson 1988 for third year project. Irrad by J.Scott 1990/1.

Sherd.	Description.	Results.
HAL7	BG body frag	ATHENIAN
HAL8	BG body frag	ATHENIAN
HAL9	BG base bwnish circles on underside	ATHENIAN
HAL10	BG base tan clay unglazed on underside	OUTLIER
HAL11	Thk base BG out red glaze on underside	"
HAL12	BG BS with rim and handle stump	ATHENIAN
HAL13	Curved bwnish BG Body frag	ATHENIAN
HAL14	BG Rim	ATHENIAN
HAL15	BG Handle	ARGOS
HAL16	BG Complete handle	ATHENIAN
HAL17	BG Body frag	ATHENIAN
HAL18	BG Body frag greyish clay	ATHENIAN
HAL19	BG Body frag tan clay	ARGOS
HAL20-22	BG body frag	"
HAL23	BG rim tan clay with deposits	OUTLIER
HAL24	BG body frag	ATHENIAN
HAL25	body frag bwnish glaze	ARGOS
HAL26	BG body frag	"
HAL27	Curved BG body frag	ATHENIAN
HAL28	WORN BG body frag tan clay	SPARTA
HAL29-30	Curved BG body frag	ARGOS
HAL31,32	Body frag with deposits grnish clay	ELIS
HAL33	Curved BG body frag with deposits	OUTLIER
HAL34	BG Body frag with deposits	"
HAL35	thick BS worn red glaze in BG OUT	ARGOS
HAL38	no description available	Argive Geometric
HAL42	BG BS Handle stump	OUTLIER

Mycenae.

All selected by Dr.A.J.N.W.Prag at the Museum of Classical Archaeology, Cambridge. All sherds from the BSA excavations in 1952.

Sherd.	Description.	Results.
MY3	Large Krater body streaky bwn glaze geodec out probably AG	Argive Geometric
MY4	Body krater red glaze red.bwn clay fine white grits line H_2O birds dec argive	Argive Geometric
MY5	Rim krater pink clay dk grits H_2O birds	Argive Geometric
MY7	BS krater cream clay dec:lozenges BG different to curving Arg prob COR	Corinthian
MY8	BS krater cream surface metallic glaze purple lines out AG	Argive Geometric
MY9	BS open shape bowl bwn clay red at edges bwn flaky glaze AG	Athenian
MY10	Rim krater lid stripes BG/tan bwn gritty clay buff surface	Outlier
MY11	neck og oinochoe pale bwn clay unglazed geodec out typ AG	Argive Geometric
MY12	neck oinochoe zigzag over horiz lines	Corinthian
MY13	BS krater cream clay dk grits H_2O birds	Argive Geometric
MY14	closed shape hard fired different fabric to others, grey to red, metallic BG	Athenian
MY15	trefoil mouth oinochoe crm clay fine grits metallic red/bwn glaze COR	Corinthian
MY16	Neck sm krater pale clay unglaze geodec	Argive Geometric
MY17	Base krater pale bwn gritty clay dull BG in metallic out Subgeo oriental 7th BC	Argive Geometric
MY18	rim of kotyle thick met bwn glaze vertical chevrons out ARG or COR	Outlier
MY30	Base of krater BG out LC/HL	Argos
MY32	Rim bell krater vfine pale bwn/grey clay good met BG LC/HL	Corinthian

Sherd.	Description.	Results.
MY33	BS open shape kotyle mid bwn clay not as fine as 32, met BG, prob ARG	ARGOS
MY34	Neck BG trefoil mouth oinochoe bk clay same texture as 33 good met BG	SP-like
MY35	Rim bell krater mid bwn/orange clay muddy BG ARG clay LC/HL (drill)	ARGOS
MY36	Wall bowl bwm clay horiz grooves out worn bwn glaze out ARG Hellenistic	ARGOS
MY37	Rim/handle sykphos ben clay lighter at handle(Drilled) met BG 4thBC prob ARG	"
MY38	Handle/rim skyphos hard orange clay worn red/BG 5th-4thBC	"
MY39	Stem/base skyphos hard pale bwn/pink clay bwn good glaze ARG 4th-3rdBC	"
MY40	Twistedhandle krater pale bwn clay dull bwn glaze worn ARG	Argive Geometric
MY41	BG krater pink bwm clay fine grits raised horiz ridges vert ribbing Gnathian? (drill)	ARGOS
MY42	BS krater hard mid bwn clay fine grits met BG ivy wreath in relief 4th-3rdBC	"
MY43	BS Megarian?bowl fine pink pale bwn clay ARG? dull bwn glaze relief dec out drill	"
MY44	Base sml dish pink pale bwn clay ARG? horiz grooves/ridges res glaze 3rdBC	"

Mycenae.

Selected by Dr.E.French of the BSA, from the British excavations, (1967), collection at the Naplion museum. Sampled at the Nauplion storerooms.

Sherd	Description.	Results.
MYC01	BG BS reserved line out	CORINTHIAN
MYC02	BS reserved line out good quality BG	ATHENIAN
MYC04	Lamp base (drill)	ARGOS
MYC05	BG BS matt white lines out	ARGOS
MYC06	BS BG fine vertical grooving	ARGOS
MYC07	BS mottled clay Rouletted/stamped	ARGOS
MYC08	BG BS broad vertical grooving	ARGOS
MYC09	BG neck of jug	ARGOS
MYC10	BG BS of plate	ARGOS
MYC11	BG BS of bowl	ARGOS
MYC12	BG BS of shallow bowl	ARGOS
MYC14	BS with mottled fabric	ARGOS
MYC15	BG BS of shallow bowl	ARGOS
MYC16	Large Handle (drill)	SP-like
MYC17	BS bowl line of rouletting in	ARGOS
MYC18	BG BS reserved foot hard clay	ARGOS
MYC19	BG rim	ARGOS
MYC20	BG BS carinated bowl	ARGOS

Nemea.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. All Black Glaze samples, catalogue names 1991.58-80.

Sherd.	Description	Analysis results.
NEM58	Rim of lekane	ARGOS
NEM59	Base of plate	ARGOS
NEM60	Base of bowl	ARGOS
NEM61	Foot of bowl	ARGOS
NEM62	Foot/Base of large bowl	ARGOS
NEM63	Base mug/cup	ARGOS
NEM64	Rim of cup ?	ARGOS
NEM65	Foot of attic skyphos	ATHENIAN
NEM66	Foot of attic skyphos	ATHENIAN
NEM67	Column Krater Handle	ARGOS
NEM68	BS of mug	ATHENIAN
NEM69	Small bowl	CORINTHIAN
NEM70	BS of bowl	ARGOS
NEM71	BS of mug	ARGOS
NEM72	Krater body frag	CORINTHIAN
NEM73	Foot of small bowl	CORINTHIAN
NEM74	Base of plate/bowl	ARGOS
NEM75	Rim of bowl	ARGOS
NEM76	Ring base og skyphos	OUTLIER
NEM77	Base of bowl	OUTLIER
NEM78	Base of skyphos	ATHENIAN
NEM79	Wall of oinochoe	CORINTHIAN
NEM80	Base of skyphos	ARGOS

Olympia.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum. Sampled, by drilling, by J.Tomlinson and B.J.Colston for third year projects. Irrad by J.Scott 1990/1.

Sample	Sherd	Description.	Results.
OLY01	76	Banded amphora	OUTLIER
OLY02	45	BG rim of skyphos	ATHENIAN
OLY03	46	BS jug/psykter tan clay	OUTLIER
OLY04	9	Tan clay colour handle	OUTLIER
OLY05	10	Tan body frag	OUTLIER
OLY06	47	COOKING POT ORANGE/GREY CLAY	OUTLIER
OLY07	82	Stamped lekythos	ATHENIAN
OLY08	11	no description available	ATHENIAN
OLY09	84	Stamped kantharos	ARGOS
OLY10	85	Shallow bowl/dish	OUTLIER
OLY11	39	Stemmed Kantharos	ELIS
OLY12	40	BG Body frag	OUTLIER
OLY13	41	BG BS of skyphos	ELIS
OLY14	12	red glazed body frag	CORINTH
OLY15	42	BG handle stump of skyphos	ATHENIAN
OLY16	13	Tan clay colour body frag	ATHENIAN
OLY17	43	Body frag tan clay worn BG out	OUTLIER
OLY18	14	measuring mug tan clay	ATHENIAN
OLY19	44	BG measuring mug	ATHENIAN
OLY20	15	decorated BS of bowl grey clay	OUTLIER
OLY21	48	Kiln calcied material BYZT	OLYMPIAN
OLY22	16	Thick bwn BS kiln waster BYZT	OLYMPIAN

Peracora.

All selected by Dr.A.J.N.W.Prag at the Museum of Classical Archaeology, Cambridge. All thought to be Corinthian.

Sherd.	Description.	Results.
PC1	BS krater white on blk style fine vhard pale bwn clay dull bwn glaze. GEOCOR	Corinthian
PC3	Geo cup rim/wall cream clay thk bwn glaze in lines out (drill)	"
PC7	BG closed shape, oinochoe, crm clay vfine surface geodec L8thBC (drill)	Corinthian
PC10	Rim kalathos vfine crm clay incised dec out dull bwn glaze (drill)	Corinthian
PC13	BS mini conical oinichoe vfine crm clay fine linear dec L8thBC (drill)	Outlier
PC15	" with pale bwn clay thk clay. (drill)	Corinthian
PC16	Conical oinochoe lower body vpale bwn clay dec:lines, rays EPCOR	Corinthian
PC20	Pyxis wall/base pale bwn clay zigzag in bwn glaze radial bands out LG/EPCOR	Corinthian
PC22	Lid crm clay fine grits bot unglazed top dull BG incised radial lines ECOR (drill)	Corinthian
PC24	Knob of lid(pyxis) vfine crm clay bands good bwnish BG 8th-6thBC (drill)	Corinthian
PC27	" fine hard crm clay, tongues in RG out	Corinthian
PC34	Sm kotyle hard pale bwn/pink clay RG out	Corinthian
PC35	Aryballos(football type) crm clay out: fine lines incised radiating out dull BG	Corinthian
PC40	Base conical oniochoe crm/green glaze radial lines bot purple on BG top plain	"
PC41	Pyxis wall, crm clay wavy lines in red	Corinthian
PC42	Miniphiale crm clay red wash bg circle out	"
PC45	BS kotyle vhard crm clay dull BG out	"
PC47	kalathos lowBS some "basketry" crm clay horiz bands blk wash/purplish (drill)	Corinthian
PC54	Base mini vase vpale bwn glaze grits unglazed	Corinthian

Sparta.

All selected by Dr.A.J.N.W.Prag at the Manchester Museum for S.Foy's third year porject. Reanalysed for short and some long by J.Scott. There are no descriptions for the sherds, except that they are all Black Glaze.

Tanagra.

All sherds were selected by Dr.A.J.N.W.Prag at the Manchester Museum. They were all Black Glaze sherds.

Sherd	DESCRIPTION.	ANALYSIS RESULTS.
TAN01	BG BASE	ATHENIAN
TAN02	TAN/BLACK BASE	ATHENIAN
TAN03	BROWN/TAN BASE	ATHENIAN
TAN04	RED BASE	ATHENIAN
TAN05	BG BASE	ATHENIAN Multi's 20-23 Same.
TAN06	BLK/TAN HANDLE	ATHENIAN
TAN07	"	ATHENIAN
TAN08	HANDLE ZIGZAG BLK	ATHENIAN
TAN09	"	EUBOEAN Multi's 24-27 Same.
TAN10	"	OUTLIER
TAN11	GREY/BLK SIDE	ATHENIAN
TAN12	"	ATHENIAN
TAN13	RIM BG/BWN ON TAN	ATHENIAN
TAN14	DIRTY BWN SIDE	ATHENIAN Multi's 28-31 Same.
TAN15	BG HANDLE	ATHENIAN
TAN16	BG BASE	ATHENIAN Multi's 32-35 Same.
TAN17	BG SIDE	ATHENIAN
TAN18	BLK/BWN BASE	ATHENIAN Multi's 36-40 Same.
TAN19	BG/GREY SIDE	ATHENIAN

Tiryns.

Selected by one of the Naplion museum staff for the German archaeologist who was away. Sampled at the Tiryns storerooms. A mix of Classical and Hellenistic.

Sample	Sherd	Description.	Results.
T1/2	LX135/88IIa	BG BS of cup	ATHENIAN
T1/3	R9 MO 75	BG Rim	Tiryns Gp 1
T2/1	LXII 43/28II	BG Body Sherd	Tiryns Gp 1
T2/2	LXII43/66IIb	"	Tiryns Gp 1
T2/3	LXII 45/48 I	"	Tiryns Gp 1
T3/1	LXII44/69IIb	"	"
T3/3	LXI 41/74 I	"	Sp-like
T4/1	LXII 44/20II	BG Lamp base	ATHENIAN
T4/2	LXIV 44/20II	BG Base of an attic skyphos	ATHENIAN
T4/3	KW11II(G4)	BG Base	ARGOS
T5/1	LXIV45SCh1	Very curved BG rim ofjug	ATHENIAN
T5/3	LXIV45SCh1	Base/wall of jug BG Tan clay	CORINTH
T6/1	LXIV45/78I	BG base with ring foot of jug	"
T6/2	LIX 37Ia	"	ATHENIAN
T7/1	LXII35/31IIi	Horizontal handle BG	ARGOS
T7/2	LX11135/4IId	Base of kylix foot BG out tan in	ATHENIAN
T7/3	KW 14 II	Body frag BG	ARGOS
T8/1	LX1 44/97 Ib	BG base Bwn line around base	ATHENIAN
T8/2	LXIV45/85I	BG Body frag	OUTLIER
T8/3	LX44/58 Ib	BG nozzle from lamp	ARGOS
T9/1	LX139/79Ib	BG Body frag	ARGOS
T9/2		BG body frag with red undercoat	ARGOS
T9/3	LXII35/37IIa	BG Body frag	SP-like
T10/1	LXI44/8 nT3	BG base with ring foot of bowl	Tiryns Gp 1
T10/2	LXII44/26Ib	BG ribbon handle	ARGOS
T10/3	LXI 11/36 II	BG Body frag	ARGOS
T11/1	LXI44/35II	thick BG handle	Tiryns Gp 1

T11/2	LX111 45 sch	ribbon handle BG	ARGOS
T11/3	LXII35/6II	"	Tiryns Gp 1
T12/1	LIX40/83-86I	Large rim of krater BG	Tiryns Gp 1
T12/2	LXIV43/60II	BG Base of cup	ATHENIAN
T12/3	LXII43/11IIb	BG base with ring foot	OUTLIER
T13/1	LXI42/87II	BG Body frag	ARGOS
T13/2	LXII93/65II	"	ARG GEO
T13/3	LXII35/76II	Frag of BG krater handle	ARG GEO
T14/1	LXI36/9II	BG rim red glaze in	ARGOS
T14/2	LXIV45/51I	BG Body frag	SP-like
T14/3	LX36/15-16	Shoulder of large vessel BG	SP-like
T15/1	LXIV45schI	BG Rim of krater	Tiryns Gp 1
T15/2	LXIII45/16	BG Body frag	SP-like
T15/3	LX1134/97II	Base vshiny BG not on underside	ATHENIAN

Tiryns.

All selected by Dr.A.J.N.W.Prag at the Museum of Classical Archaeology, Cambridge.

Sherd.	Description.	Analysis.
TI1	BS of lge krater hard clay dark met glaze neat geodec out LG	Argive Geometric
TI3,4,11	BS of GA krater	"

Tiryns.

All selected by Dr.N.Korou at the University of Athens. All samples of Argive Handmade wares

Sherd.	Description.	Results
OM101-3,5-7,	HW fine no grit red/yellow clay polished surface	CORINTHIAN
OM104,8-12, 14-15	HW fine no grit pink/white clay polished surface	"
OM113	like OM101 but poorer fabric	OUTLIER
OM2A01,3-6, 9-12	BS Coarse gritty HW Bucchero type soft dark grey clay.	OM2
OM2A02,7,8	"	OUTLIER
OM2B01-5,7-15	BS Argive HW soft red/bwn levigated clay small grits	OM2
OM2B06	"	OUTLIER
OM2B16	"	OM2
OM2C01-9	BS Argive HW soft dark red clay sml grit	"
OM301-4,7	BS Arg HW hard bwn/grey clay sml grits	OUTLIER
OM305,6,8,10, 12-23	"	ARGIVE HW
OM309,11	"	OUTLIER
OM401,6,9,10	BS Arg HW red/orange/tan clay sml grits	ARGIVE HW
OM402-5,7,8	"	OM5B
OM5A1, 5	BS Argive HW tan/bwn clay sml grits	"
OM5A2-4,6-10	"	ARGIVE HW
OM5B1-10	BS Argive Monochrome ware tan/bwn clay sml grits	OM5B

Various POT Samples.

Selected by Dr.A.J.N.W.Prag at the Manchester Museum. All drilled from ( ).

Sample	Sherd	DESCRIPTION.	RESULTS.
POT01	20000	BGFig lekythos deer painting (base)	EUBEOA
POT02	IIIG.6	Lekane vlong handle (BASE)	OUTLIER
POT03	IIIG.2	Plate with handles BG centre/dec (base) BEO??	OUTLIER
POT04	IIIB.5	Pyxis BG leaf pattern (base) (BEO)	OUTLIER
POT05	IIIG.5	Plate with handles BG in dec out (base) (Camp)	OUTLIER
POT06	IIIG.4	Bowl+handles BG in dec out (base)	OUTLIER
POT07	IIIG.3	Plate with handles BG in BG/bwn pattern out (base) (BEO)	BOETIAN
POT08	IIIG.9	" BG in BG/pale clay out ivy leaf/zigzags (base) (BEO)	BOETIAN
POT09	IIIH.5	Large BFig vase fighting scene 4 men watch soft(base) Attic Hydra	ATTIC
POT10	B91	Vase+vlge handles BG/RG(Base) (Camp/Beo?)	OUTLIER
POT11	1986.170	BG Tulip cup 1 handle (Base)	OUTLIER
POT12	1986.146	Attic blk figure kylix (side)	ATTIC
POT13	1986.147	Attic Blk Fig cup/Skyphos (Side)	ATTIC
POT14	1986.152	BG vessel (BEO)	OUTLIER
POT15	1986.153	Kylix Blk figure out BG in (side)	OUTLIER
POT16	1986.156	BG Body frag (side)	ATTIC
OT17	1986.158	Attic BS Blk figure Kylix/Skyphos	ATTIC
POT18	1986.154	Skyphos 2 figs talking (rim) Attic	ATTIC
POT19	1986.181	Kantheroi trophy shape (base)	EUBOEA
POT20	1986.182	Kantheros/cup 1 handle RG (base)	OUTLIER
POT21	1986.183	" soft clay (base)	OUTLIER
POT22	1986.184	Kantheroi BG Ribbing out (base)	OUTLIER
POT23	1986.185	Blk/red bowl+handles (base) (Euba)	EUBOEA
POT24	1986.187	Skyphos/bowl BG (Base)	ATTIC
POT25	1986.188	Deep rim bowl BG horiz red lines (rim)	OUTLIER

APPENDIX 3:

GROUP INFORMATION

Akraiphnion.

Group Members: AK26-28, 30-35.

Other sherds found to similar to Akraiphnion:

POT8 Museum Piece.
POT07 Museum piece, similar suggesting Boeotian origin.

Distinguishing elements: High Cs and low Na, Rb.

Mean Concentration:

ELEMENT	MEAN	ST. DEV.	%
Na%	0.303	0.05	17.39
Al%	8.68	0.25	2.93
K%	1.37	0.33	24.08
Ca%	5.55	0.49	8.92
Sc	24.8	1.32	5.36
Ti%	0.501	0.04	9.09
V	132	14.5	11.00
Cr	435	28.0	6.43
Mn	911	80.2	8.81
Fe%	6.69	0.40	5.96
Rb	77.4	22.6	29.22
Cs	3.8	1.00	26.15
La	31.7	0.86	2.73
Ce	65.8	5.29	8.04
Dy	4.21	0.51	12.19
Lu	0.390	0.11	29.87
Hf	3.56	0.34	9.73
Th	11.1	0.61	5.44
U	2.47	0.57	23.01

Argos

Group Members: ARG1,2, 5, 6, 8, 9, 14-17, 19.

Others sherds found to be from Argos or surrounding area:

AR4 AG from Argos.
ARG12, 13 BG from Argos members after odd concs removed.
B2, 3, 5, 7-10, 14, 16, 17-20, 26, 31-33, 35, 36, 38-40, BA7, 8 BG from Berbati, (B: Classical and Hellenistic, BA: Archaic).
HAL15,19-22,25,26,29,30,35 BG from Halieis
MY30,33,35-39,41-44, MYC4-15, 17-20 BG from Mycenae.
NEM58-64,67,70,71,74,75,80 BG from Nemea.
OLY8, 19, 20 BG from Olympia.
T4/3, 7/1,3, 8/3, 9/1,2, 10/2,3, 11/2, 13/1, 14/1 BG from Tiryns.
UP20, 22, 25-27, 30-33, 35, 36, 38, 51 BG from Asine.

Distinguishable Elements: High Mn

Mean Concentration:

ELEMENT	MEAN	ST. DEV.	%
Na%	0.715	0.10	14.11
Al%	8.82	0.38	4.40
K%	2.59	0.36	14.19
Ca%	4.67	1.24	26.72
Sc	19.9	1.01	5.05
Ti%	0.486	0.05	10.49
V	118	14.4	12.22
Cr	248	27.5	11.11
Mn	1248	146	11.74
Fe%	5.20	0.35	6.78
Rb	130	14.6	11.24
Cs	6.58	0.85	12.93
La	39.4	4.22	10.72
Ce	76.74	7.03	9.17
Dy	5.92	0.51	8.64
Lu	0.458	0.04	8.92
Hf	5.47	0.45	8.29
Th	12.9	0.98	7.64
U	3.35	0.28	8.46

Argive Geometric.

Group Members: MY3-5,8,11,13,16,17,40

Other sherds found to be of similar compostion:

AH1,2,BM76,83,90,93,95,107,11,115,118,122,239,241 ArgiveGeometric from Argive Heraeum.
AS20-25 Argive Geometric from Asine.
AR3 Argive Geometric from Argos.
TI1,3,4,11, T13/2,3 Argive Geometric from Tiryns.
UP1, 2, 5, 6 Geometric Ware from Asine.
B27,29,30, BA1,12,14,16,18 BG from Berbati.
HAL38 BG from Halieis.

Distinguishing elements: low Rb, high Ca.

Mean Concentration:

ELEMENT	MEAN	ST. DEV.	%
Na%	0.948	0.09	9.76
Al%	7.68	0.36	4.78
K%	1.97	0.40	20.73
Ca%	9.15	1.22	13.41
Sc	19.2	1.20	6.27
Ti%	0.457	0.04	9.76
V	98.0	7.15	7.30
Cr	208	16.5	7.93
Mn	978	73.1	7.47
Fe%	4.95	0.29	5.97
Rb	102	9.92	9.71
Cs	5.65	0.65	11.63
La	30.2	1.98	6.57
Ce	62.8	4.70	7.49
Dy	4.32	0.36	8.35
Lu	0.380	0.07	18.07
Hf	4.56	0.34	7.56
Th	10.9	0.69	6.36
U	3.60	0.36	10.07

Argive Handmade Ware.

Group Members: AM01-12, 14, 17-19, 25-27, 30-43.

Other members of the group:

OM306, 8, 11-23, OM401, 6, 9, 10, OM5A2-4, 6-10 Argive Handmade ware from Tiryns

Distinguishable Elements:

Mean Concentrations:

Element	Mean	SD	%
Na%	0.377	0.11	28.47
Al%	7.98	0.63	7.92
K%	2.76	0.38	14.00
Ca%	8.10	1.46	18.14
Sc	23.3	1.75	7.52
Ti%	0.403	0.03	9.21
V	134	12.3	9.23
CR	397	66.3	16.71
MN	917	154	16.87
FE%	5.67	0.42	7.44
RB	132	18.5	14.01
CS	8.14	1.09	13.39
LA	26.75	2.52	9.42
CE	52.0	5.41	10.39
DY	3.69	0.40	10.90
LU	0.361	0.07	19.75
HF	2.75	0.32	11.65
TH	9.4	0.96	10.24
U	3.55	0.75	21.35

Asine Group 1.

Group Members: UP3, 4, 7, 15, 34, 40

No other members of the group, but similar to Tiryns Group 1.

Distinguishable Elements: Low Cr and Mn

Mean Concentrations:

Element	Mean	SD	%
Na	0.802	0.06	6.97
Al	9.16	1.22	13.39
K	3.68	0.71	19.27
Ca	4.35	1.43	32.90
Sc	19.9	2.01	10.10
Ti	0.534	0.06	11.16
V	118	16.9	14.25
Cr	182	25.6	14.08
Mn	540	125	23.11
Fe	4.74	0.23	4.83
Rb	160	13.1	8.21
Cs	8.75	0.52	6.02
La	35.9	2.19	6.12
Ce	72.1	6.29	8.73
Dy	4.95	0.39	20.17
Lu	0.412	0.03	8.49
Hf	4.90	0.74	15.13
Th	13.2	1.05	7.94
U	3.35	0.45	13.45

Athens.

Group Members: AG1, 3, 5-9, 11, 13-19, 21, 23-29, 31, 32, 34-40, 42-45.

Other sherds found to be Athenian:

AG2, 4, 10, 12, 13 from Athens after odd concs removed
ARG20 BG from Argos.
CH4,41,45,47,56 BG from Chalkis.
IK6 found at Iktanu, Jordan.
HAL7-9,12-14,16-18,24,27 BG from Halieis.
LA1-11,16-19,25-30 found at Lachish,Israel
MYC02 BG from Mycenae.
NEM65,66,68,78 BG from Nemea.
OLY15 BG from Olympia.
TAN1-8,11-19 Bg from Tanagra.
T1/2,4/1,2,5/1,6/2,7/2,8/1,12/2,15/3 BG from Tiryns.
POT9, 12, 13, 16-18, 24 Museum pieces.
UP8, 11, 16, 18, 19, 21, 28 Asine Black-Figure Ware.

Distinguishable Elements: High Cs and Ce and low Mn.

Mean Concentrations:

ELEMENT	MEAN	ST. DEV.	%
Na%	0.561	0.06	10.65
Al%	9.15	1.01	11.07
K%	3.00	0.29	9.82
Ca%	4.02	0.97	24.12
Sc	24.1	1.90	7.91
Ti%	0.512	0.05	9.91
V	122	17.1	13.92
Cr	567	49.7	8.78
Mn	793	106	13.36
Fe%	6.05	0.24	4.06
Rb	159	12.5	7.87
Cs	13.4	1.40	10.43
La	34.1	2.94	8.63
Ce	72.4	4.22	5.83
Dy	4.93	0.60	12.24
Lu	0.423	0.04	9.63
Hf	4.04	0.46	11.47
Th	12.9	2.00	15.47
U	2.20	0.30	14.01

Corinth.

Group Members: COR18-21, 23, CO18, 41, 43, 59, 66, 86, 90, 93, 96, 100, 102, 107, 109, 111, 112, 136, 139, 140, 142.

Other sherds found to be Corinthian:

ARG3,4 BG from Argos.
AR5 AG from Argos
AM23, 24 Argive Handmade ware from Argos
B11, 12, 15, 28, 37, 41, BA2-4, 6, 10, 11, 13, 17, 19 BG from Berbati
COR22, 24, 34, CO46, PC3,40,54 after odd concs removed
PC1,7,10,15,16,20,22,24,27,34,35,41,42,45,47 PCor from Perachora
LA22, 23, 24 found at Lachish, Israel.
MY7, 12, 15, 32, MYC1 BG from Mycenae.
NEM69, 72, 73, 79 BG from Nemea.
NTH 3, 5, 7, 9-12 Corinthian Handmade ware.
OLY2, 7, 16 BG from Olympia.
OM101-12, 14, 15 Argive Handmade ware found at Tiryns.
T5/3, 6/1 BG from Tiryns.
UP9, 10, 12, 13, 14, 17, 23, 34 BG from Asine.

Distinguishable Elements: High Ca

Mean Concentrations:

ELEMENT	MEAN	ST. DEV.	%
Na%	0.527	0.12	23.19
Al%	8.03	0.70	8.74
K%	2.20	0.38	17.16
Ca%	10.7	1.83	17.12
Sc	23.1	2.02	8.78
Ti%	0.461	0.05	11.64
V	134	16.8	12.55
Cr	256	25.3	9.87
Mn	949	94.0	9.90
Fe%	5.86	0.51	8.77
Rb	144	18.4	12.77
Cs	9.4	1.01	10.64
La	33.8	2.25	6.65
Ce	61.8	5.39	8.72
Dy	4.47	0.43	9.72
Lu	0.413	0.05	11.76
Hf	3.35	0.45	13.56
Th	11.6	0.91	7.90
U	3.44	0.60	17.63

Elis.

Group Members: Eli4, 6-17, 19, 20.

Sherds found to be from Elis:

ELI2, 3, 18 BG from Elis, (after odd concs removed)
HAL31,32 BG from Halieis.
OLY1, 3, 9, 11, 13 BG from Olympia.

Distinguishing elements: Low Cs, K, Rb.

Mean Concentration:

ELEMENT	MEAN	ST. DEV.	%
Na%	0.896	0.05	6.04
Al%	8.12	0.29	3.65
K%	1.75	0.34	19.81
Ca%	5.26	0.53	10.08
Sc	21.5	0.64	3.01
Ti%	0.469	0.03	7.53
V	104	8.17	7.83
Cr	327	41.4	12.67
Mn	1086	59.6	5.49
Fe%	5.67	0.13	2.42
Rb	108	20.6	18.92
Cs	4.76	0.92	19.46
La	31.9	1.53	4.82
Ce	63.8	2.89	4.53
Dy	4.99	0.42	8.51
Lu	0.418	0.02	5.12
Hf	4.48	0.40	8.97
Th	11.6	0.35	3.05
U	2.08	0.20	9.60

Euboean.

Group Members: E1-5,7-9,13,14,16-20,C1-3,42-44,48-55,CH2,3,8,11,12,14-16,18,20-27,29-39,41,43,44,45

Other sherds found to be from Euboea:

AK21,23,24,25 BG from Akraiphnion.
POT1, 19, 23 Museum pieces.
TAN9 BG from Tanagra.

Distinguishing elements: High Al, Cs and low Cr

Mean Concentrations:

ELEMENT	MEAN	ST. DEV.	%
Na%	0.951	0.15	15.70
Al%	10.6	0.67	6.32
K%	3.67	0.51	13.99
Ca%	3.34	0.71	21.35
Sc	23.4	1.94	8.32
Ti%	0.482	0.04	10.18
V	123	10.7	8.69
Cr	182	20.5	11.27
Mn	947	82.1	8.67
Fe%	5.66	0.47	8.44
Rb	159	16.7	10.50
Cs	9.80	1.14	11.72
La	38.5	2.44	6.34
Ce	77.6	5.28	6.80
Dy	5.35	0.51	9.61
Lu	0.431	0.06	14.68
Hf	4.08	0.77	19.04
Th	14.6	1.09	7.46
U	3.44	0.93	27.27

OM2

Group Members: OM2A1, 3-6, 9-11, OM2B1-5, 7-16, OM2C1-9

Other sherds associated with OM2:

AM22 Argive Handmade ware from Argos.

Distinguishable Elements: Very low Ca

Mean Concentrations:

Element	Mean	SD	%
Na%	0.734	0.16	22.53
Al%	7.47	0.44	5.92
K%	1.88	0.20	10.89
Ca%	1.00	0.18	18.80
Sc	16.3	0.69	4.23
Ti%	0.396	0.02	6.36
V	95.8	8.15	8.51
Cr	217	21.7	10.03
Mn	741	87.6	11.83
Fe%	4.55	0.16	3.63
Rb	94.1	14.0	14.88
Cs	4.63	0.55	11.95
La	28.6	1.90	6.63
Ce	58.6	5.98	10.21
Dy	4.21	0.38	9.21
Lu	0.358	0.04	11.62
Hf	4.97	0.52	10.61
Th	10.4	0.92	8.87
U	3.22	0.47	14.72

OM5B

Group Members: OM5B1-10

Other sherds associated with OM5B:

OM402-5, 7, 8, OM5A1, 5 Argive Handmade ware from Tiryns

Distinguishable Elements:

Mean Concentrations:

Element	Mean	SD	%
Na	0.700	0.05	8.17
Al	8.06	0.22	2.82
K	2.50	0.18	7.42
Ca	8.63	0.33	3.88
Sc	19.5	0.84	4.29
Ti	0.456	0.02	5.70
V	127	4.70	3.69
Cr	186	10.5	5.65
Mn	1170	134	11.5
Fe	5.02	0.19	3.93
Rb	117	6.94	5.89
Cs	5.77	0.39	6.86
La	30.5	1.49	4.88
Ce	62.9	3.54	5.63
Dy	4.54	0.26	5.88
Lu	0.386	0.03	7.95
Hf	3.94	0.34	8.75
Th	10.6	0.56	5.30
U	5.04	0.36	7.19

Sparta Group 1.

Group Members: SP16, 27, 32, 36, 37, 39-42

Other sherds found to be Spartan:

HAL38 BG from Halieis
MY34 BG from Mycenae

Sherds found to be similar, but for high Rb concentrations:

ARG7, 11, 18 BG from Argos
B13, 34 BG from Berbati
MYC16 BG from Mycenae
T3/3, 9/3, T14/2,3, 15/2 BG from Tiryns
UP29 BG from Asine

Distinguishable Elements: High Ce, Th and low Mn

Mean Concentrations:

Element	Mean	SD	%
Na	0.364	0.07	9.25
Al	10.0	0.52	5.23
K	1.52	0.50	33.46
Ca	3.85	0.83	21.26
Sc	21.9	1.86	8.47
Ti	0.576	0.02	3.94
V	98.3	20.2	20.60
Cr	266	49.8	18.72
Mn	1128	212	18.85
Fe	6.21	0.26	4.27
Rb	42.7	9.35	21.90
Cs	1.23	0.51	41.62
La	47.5	2.93	6.17
Ce	92.9	4.63	4.99
Dy	6.51	0.97	14.95
Lu	0.573	0.01	3.37
Hf	6.78	0.46	6.91
Th	16.8	1.06	6.35
U	4.21	1.18	28.23

Sparta Group 2.

Group Members: SP24, 29, 33, 35, 45, 47, 49

No other sherds are associated with the group.

Distinguishable Elements: low Rb and high Mn, Ce, Th

Mean Concentrations:

Element	Mean	SD	%
Na%	0.289	0.05	17.16
Al%	11.52	1.32	11.49
K%	1.25	0.39	31.54
Ca%	2.59	0.84	32.35
Sc	20.3	2.15	10.56
Ti%	0.704	0.05	7.11
V	103	22.0	21.20
Cr	172	23.6	13.71
Mn	962	107	11.19
Fe%	6.69	0.71	10.59
Rb	44.3	15.0	33.87
Cs	1.73	0.55	31.87
La	61.8	7.16	11.59
Ce	119	12.3	10.30
Dy	7.85	0.56	7.14
Lu	0.638	0.04	6.10
Hf	8.61	0.54	6.34
Th	20.3	2.41	11.90
U	4.81	0.91	19.03

Sparta like Tiryns Group.

Group Members: T14/2, 3, 15/2

No other sherds are associated with this group, but it is similar to Sparta Group 1, but for high Rb.

Distinguishable Elements: High Rb, Ce, Th

Mean Concentrations:

Element	Mean	SD	%
Na	0.508	0.02	4.24
Al	10.8	0.25	2.35
K	2.47	0.11	4.53
Ca	3.67	0.08	2.57
Sc	22.1	0.69	3.16
Ti	0.651	0.02	3.41
V	141	1.96	1.38
Cr	143	6.05	4.21
Mn	889	41.2	4.64
Fe	5.82	0.15	2.65
Rb	141	10.4	7.40
Cs	7.34	0.69	9.41
La	63.7	1.51	2.37
Ce	129	6.13	4.76
Dy	7.78	0.48	6.29
Lu	0.586	0.01	2.99
Hf	7.61	0.17	2.24
Th	18.9	0.91	4.83
U	4.56	0.06	1.47

Tiryns Group 1.

Group Members: T1/3, 2/1-3, 10/1, 11/1,3, 12/1, 15/1

No other sherds are associated with this group, but it is similar to Asine Group 1

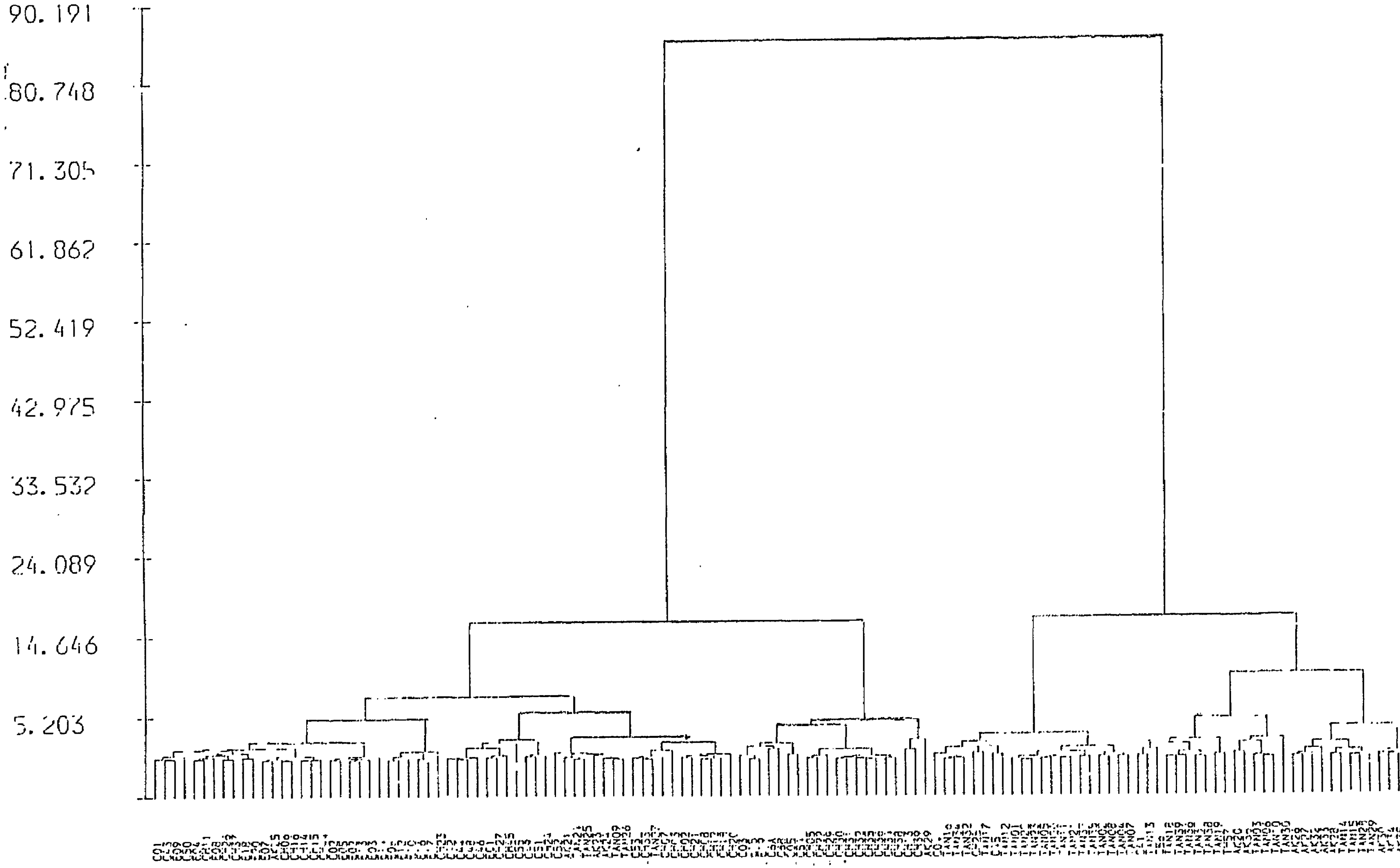
Distinguishable Elements: Low Cr and Mn

Mean Concentrations:

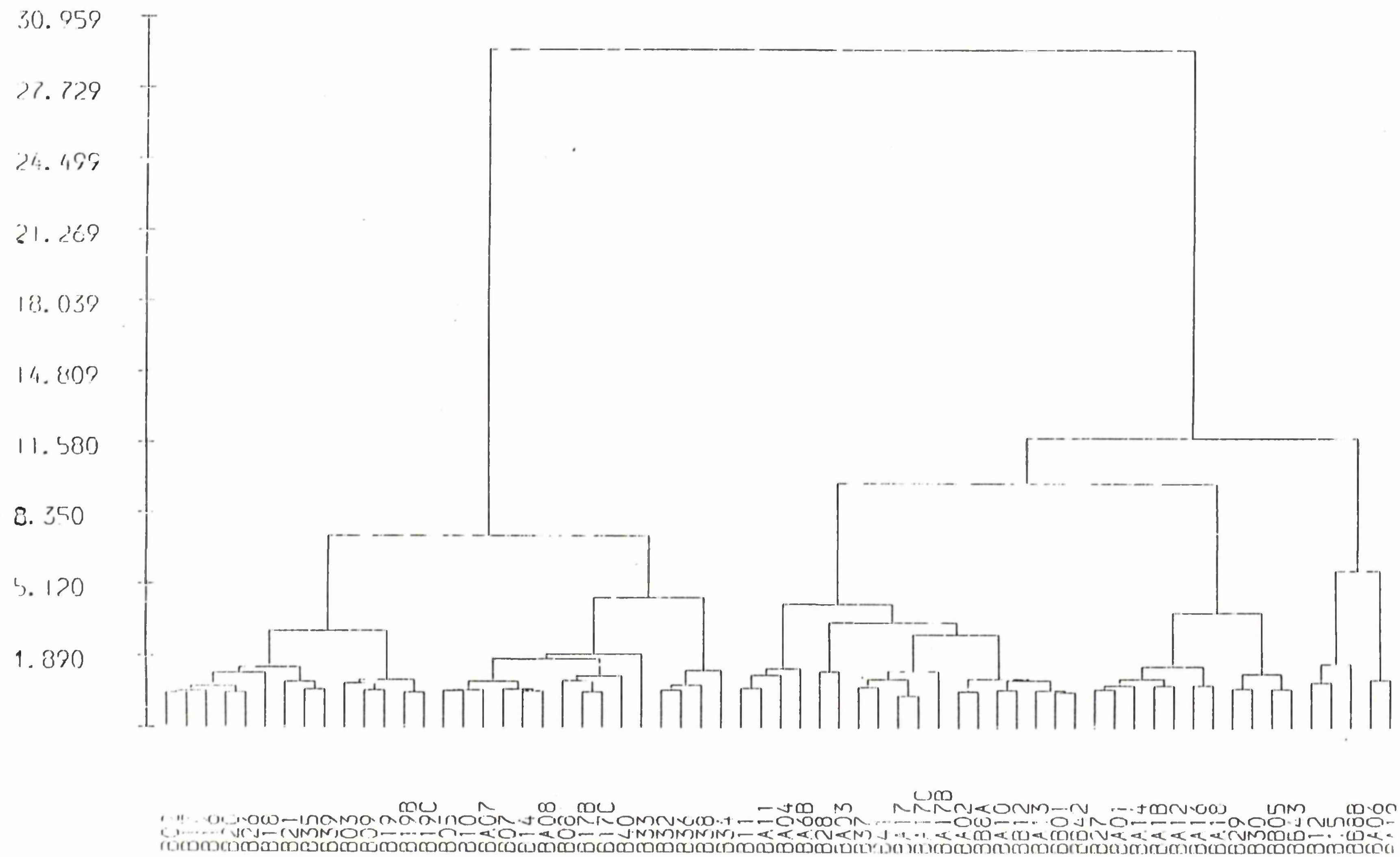
Element	Mean	SD	%
Na	0.733	0.04	5.32
Al	9.21	0.64	7.00
K	2.89	0.29	10.17
Ca	3.88	0.57	14.81
Sc	19.8	1.39	7.02
Ti	0.534	0.02	4.96
V	126	16.1	12.80
Cr	205	14.7	7.18
Mn	462	43.5	9.42
Fe	5.23	0.45	8.59
Rb	142	7.03	4.93
Cs	7.79	0.80	10.25
La	42.8	2.82	6.60
Ce	83.7	3.23	3.86
Dy	5.61	0.21	3.85
Lu	0.466	0.04	8.59
Hf	6.43	0.31	4.86
Th	14.2	0.82	5.77
U	3.41	0.25	7.45

APPENDIX 4:

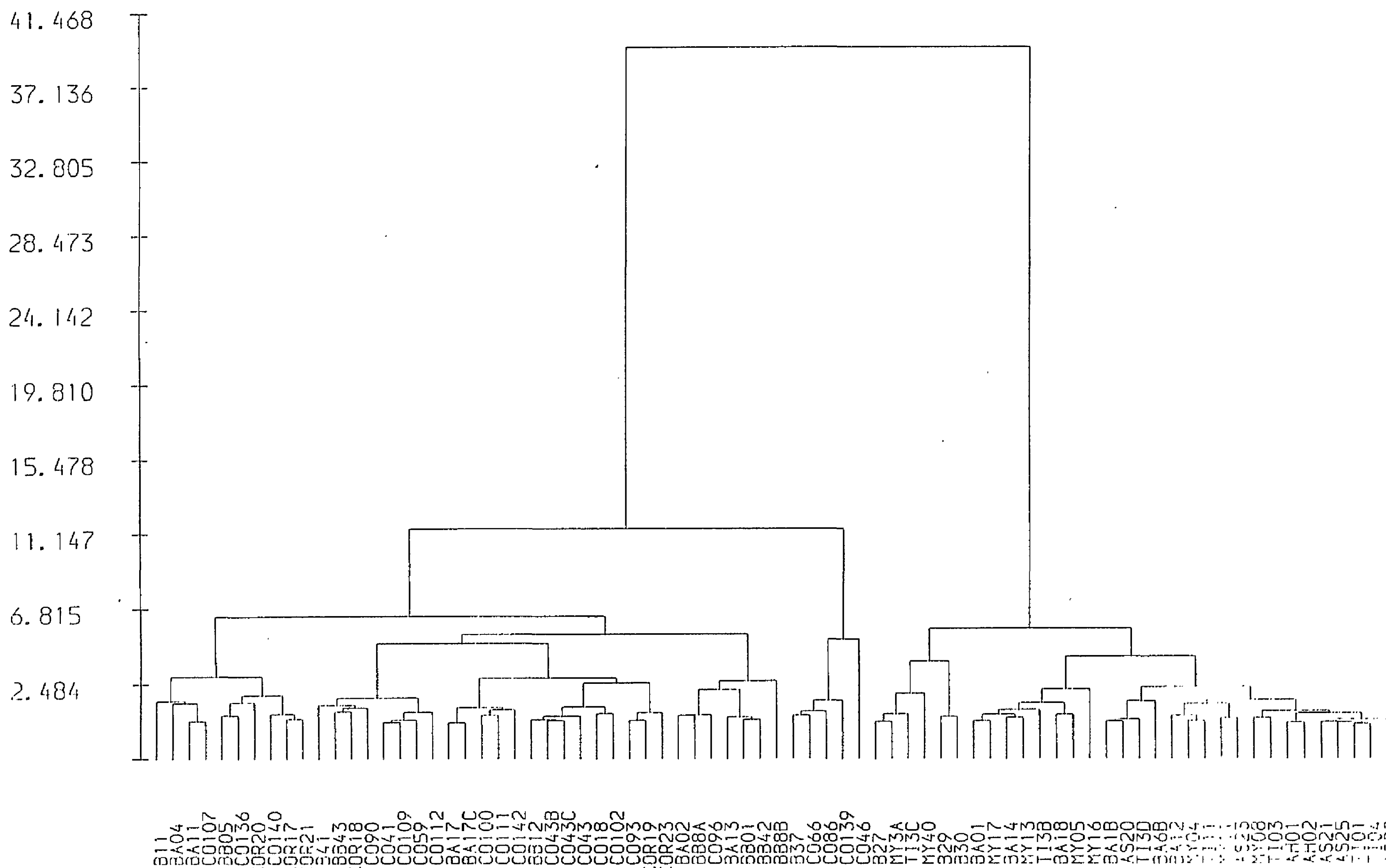
DENDROGRAMS



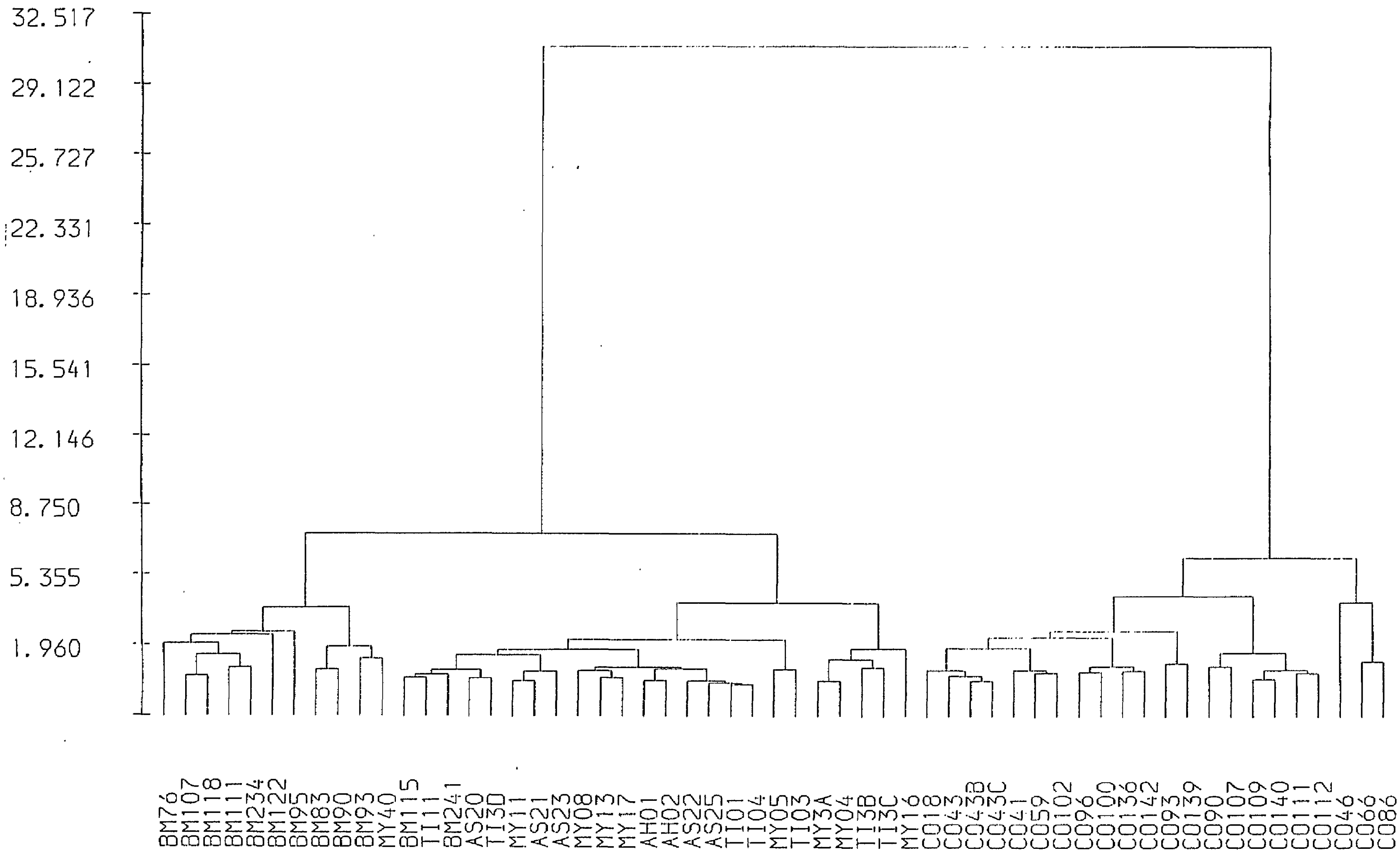
D1: Euboea and Boeotia.



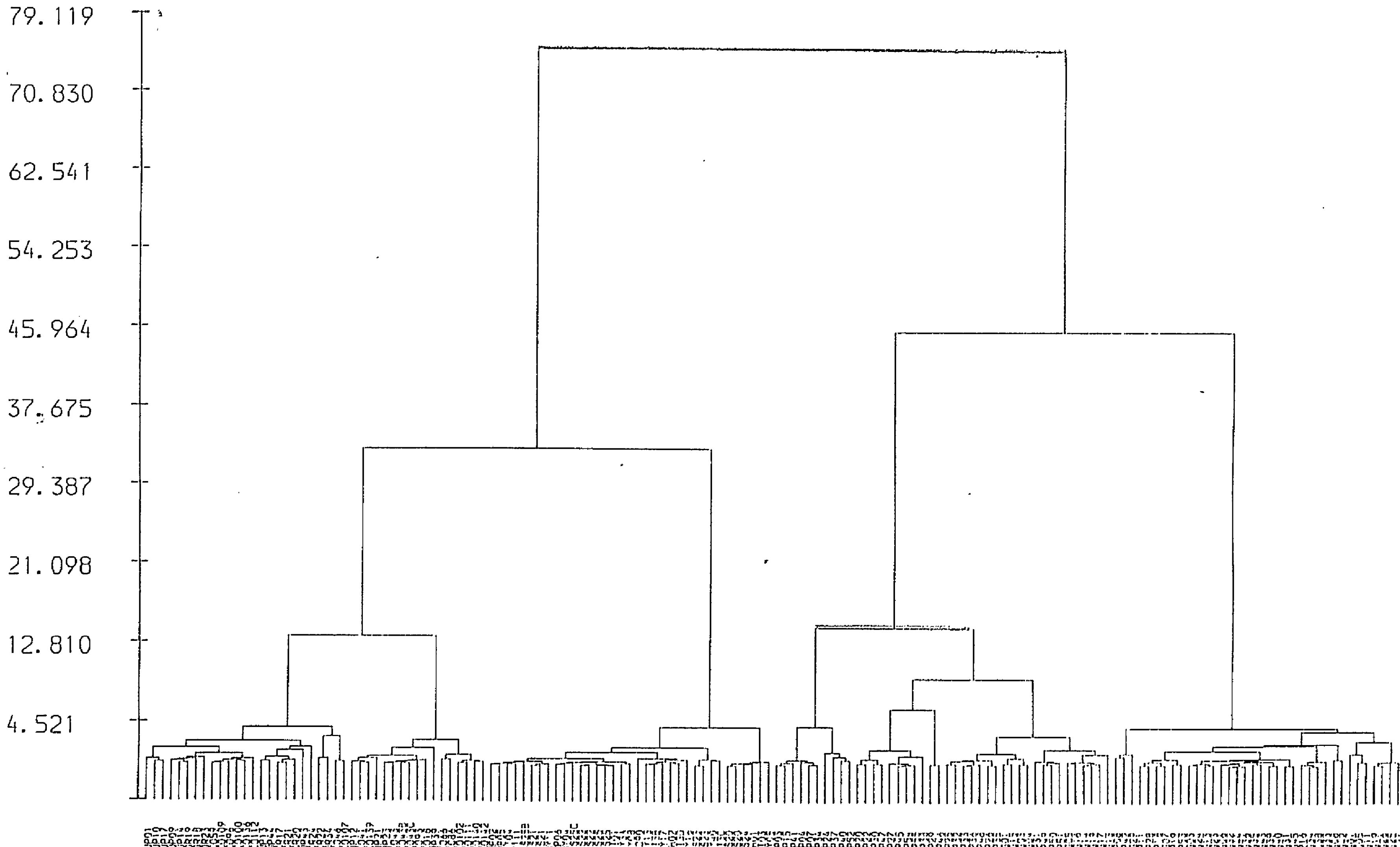
D2: Berbati Analysis, (B:Classical and Hellenistic, BA:Archaic).



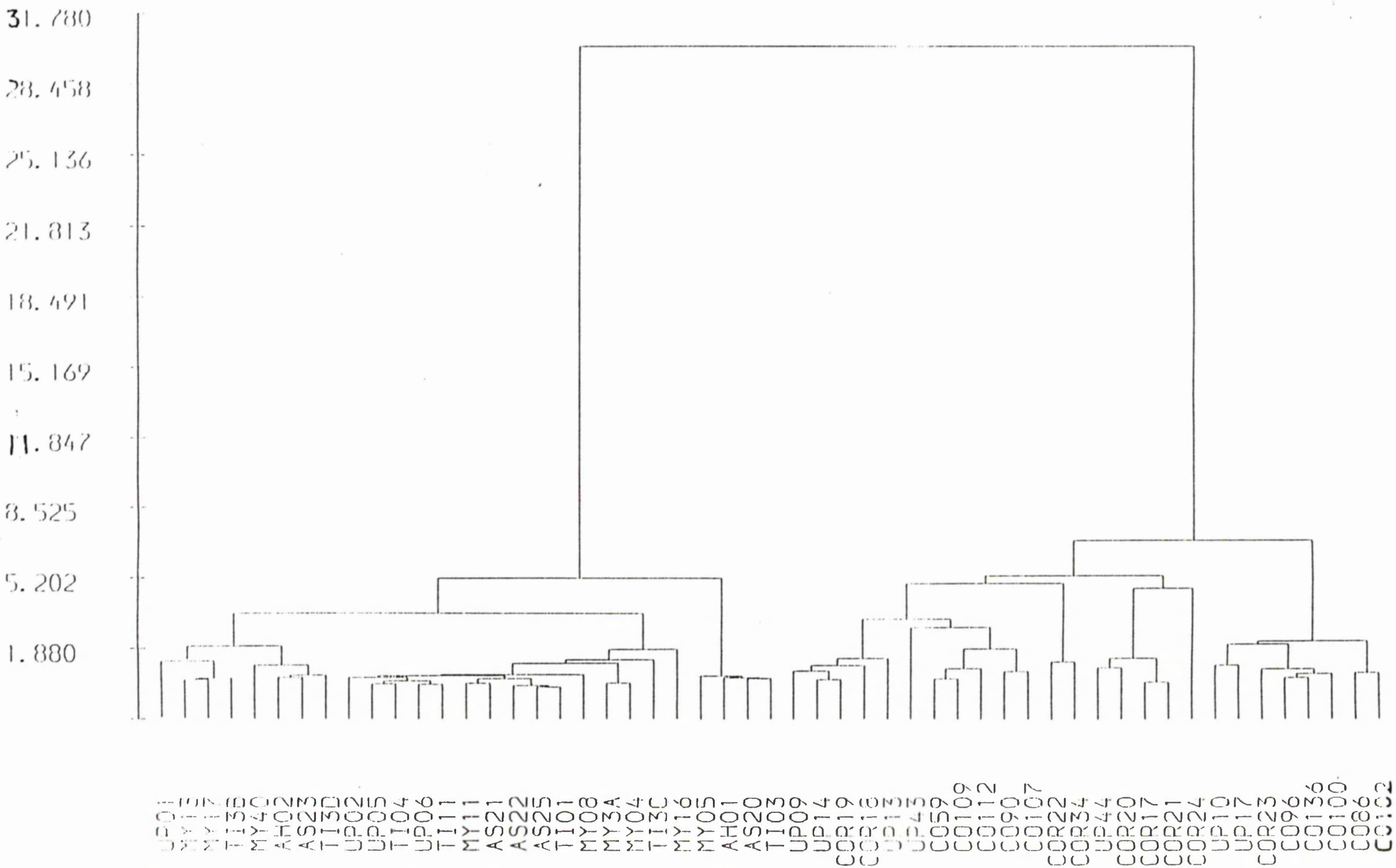
D3: Berbati (Archaic Gp, BA), Corinth, (CO) and Argive Geometric.



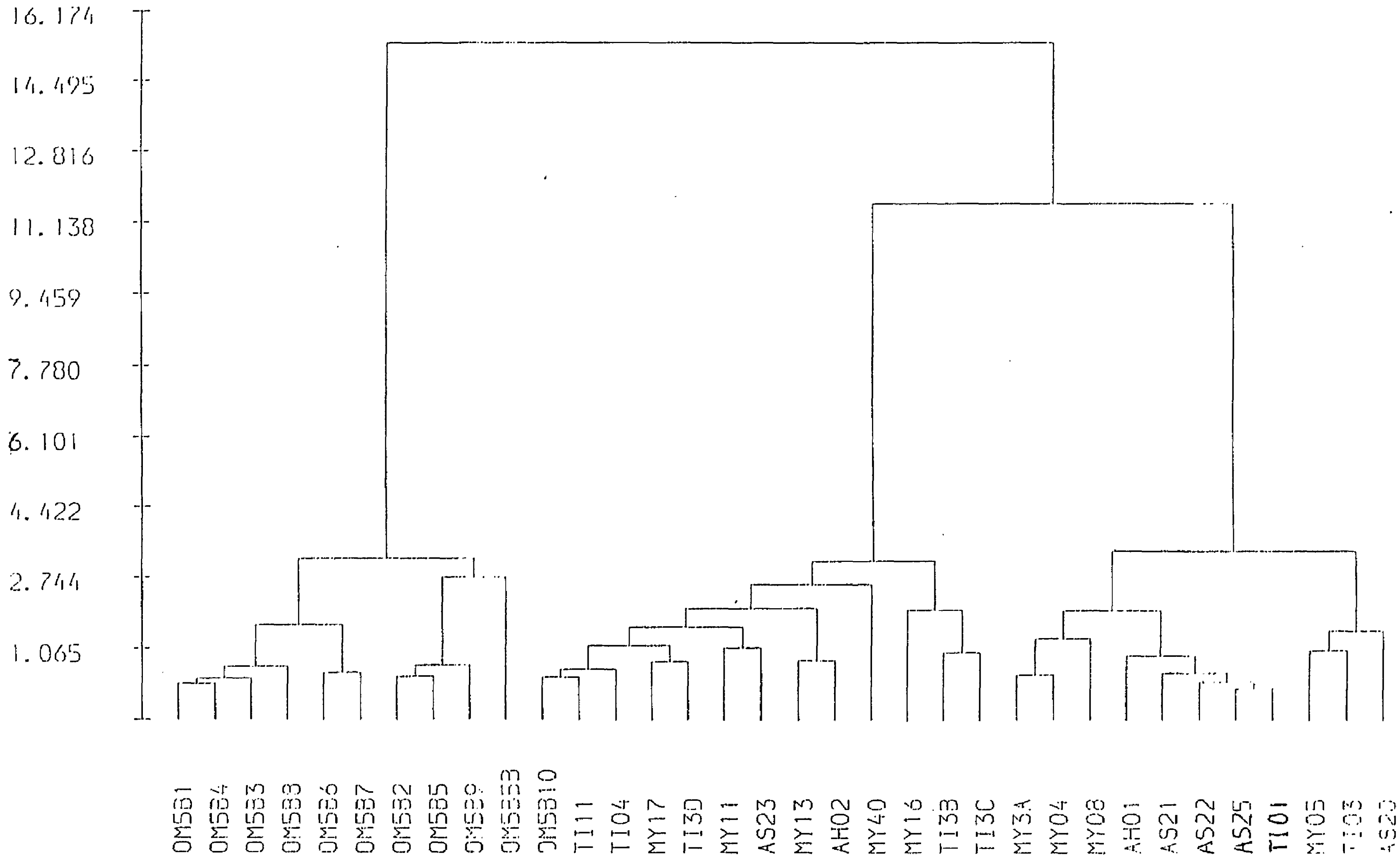
D4: Argive Heraeum, (BM), Provenance (Dilution Corrected).



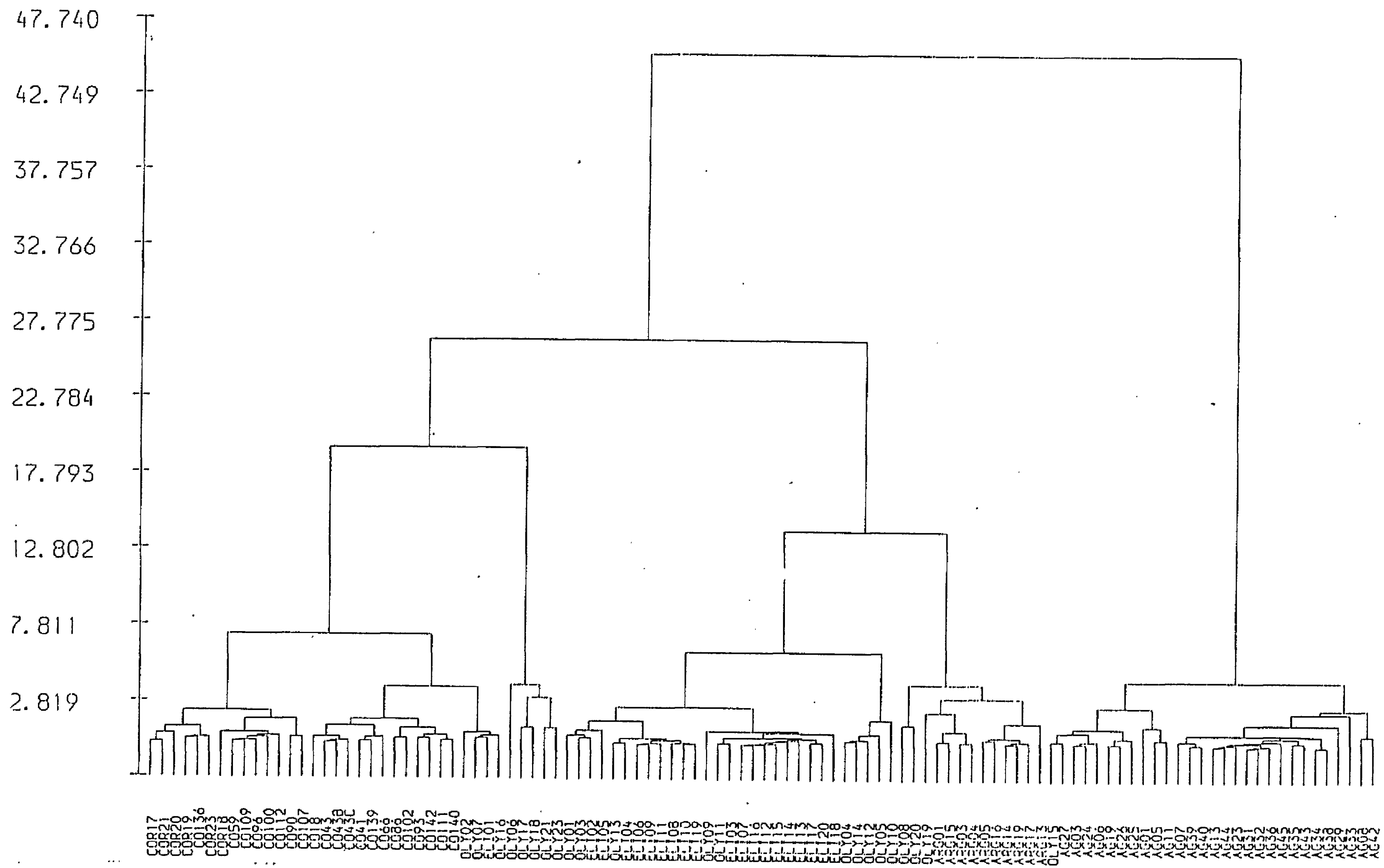
D5: Asine, (UP), Provenance.



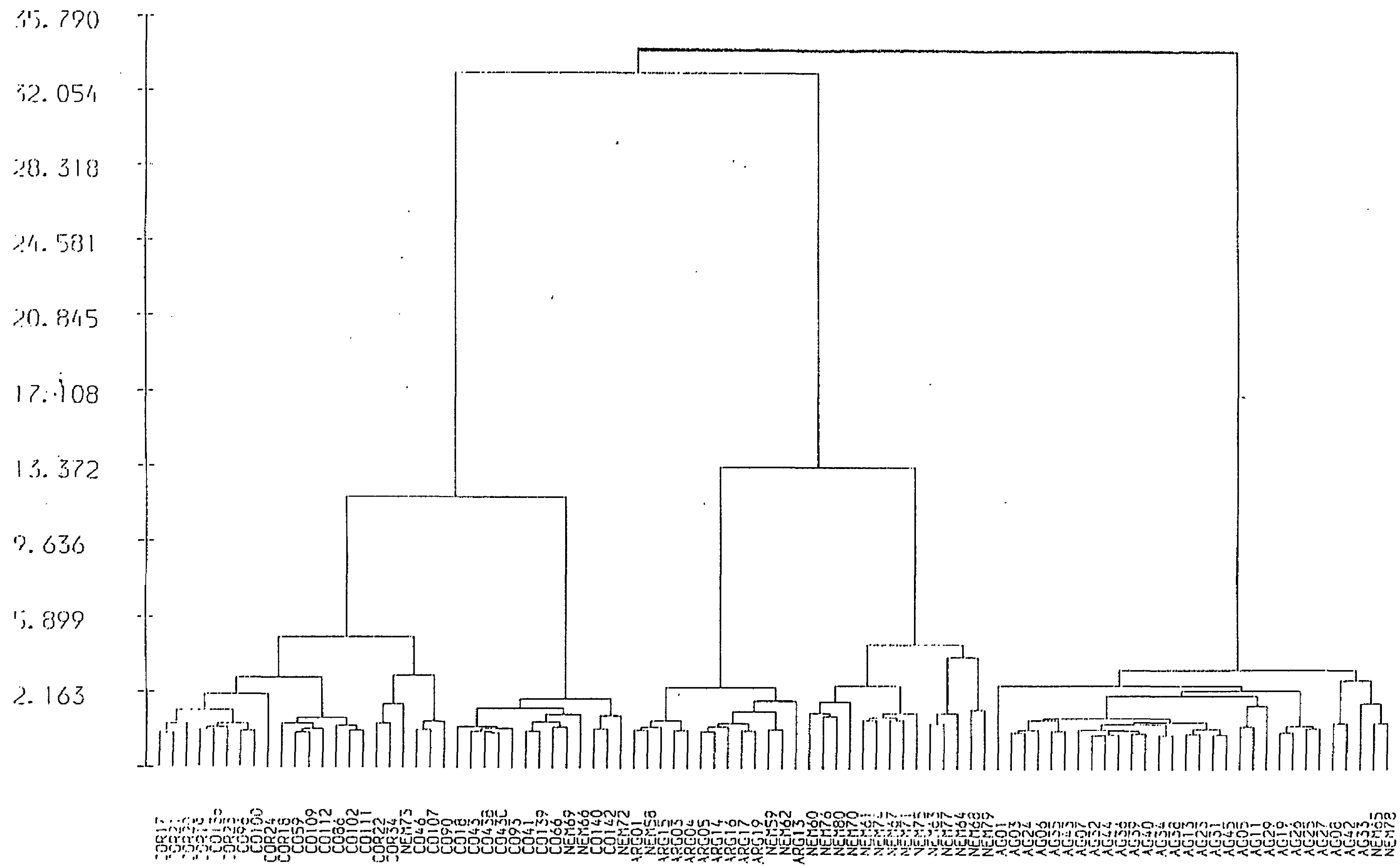
D6: Asine Group 2, (UP), Corinth, (CO) and Argive Geometric.



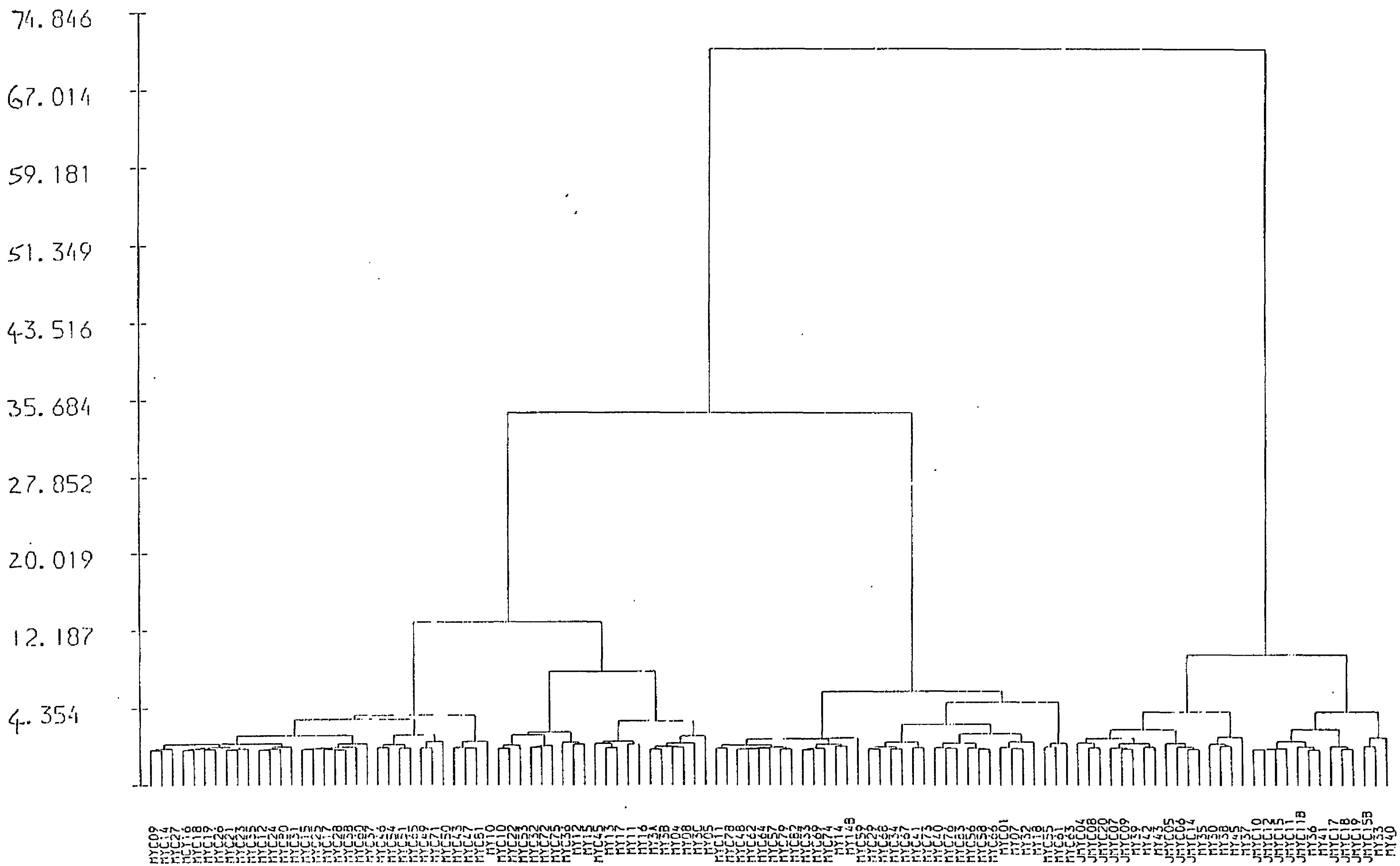
D7: OM5B (Argive Handmade Ware) and Argive Geometric.



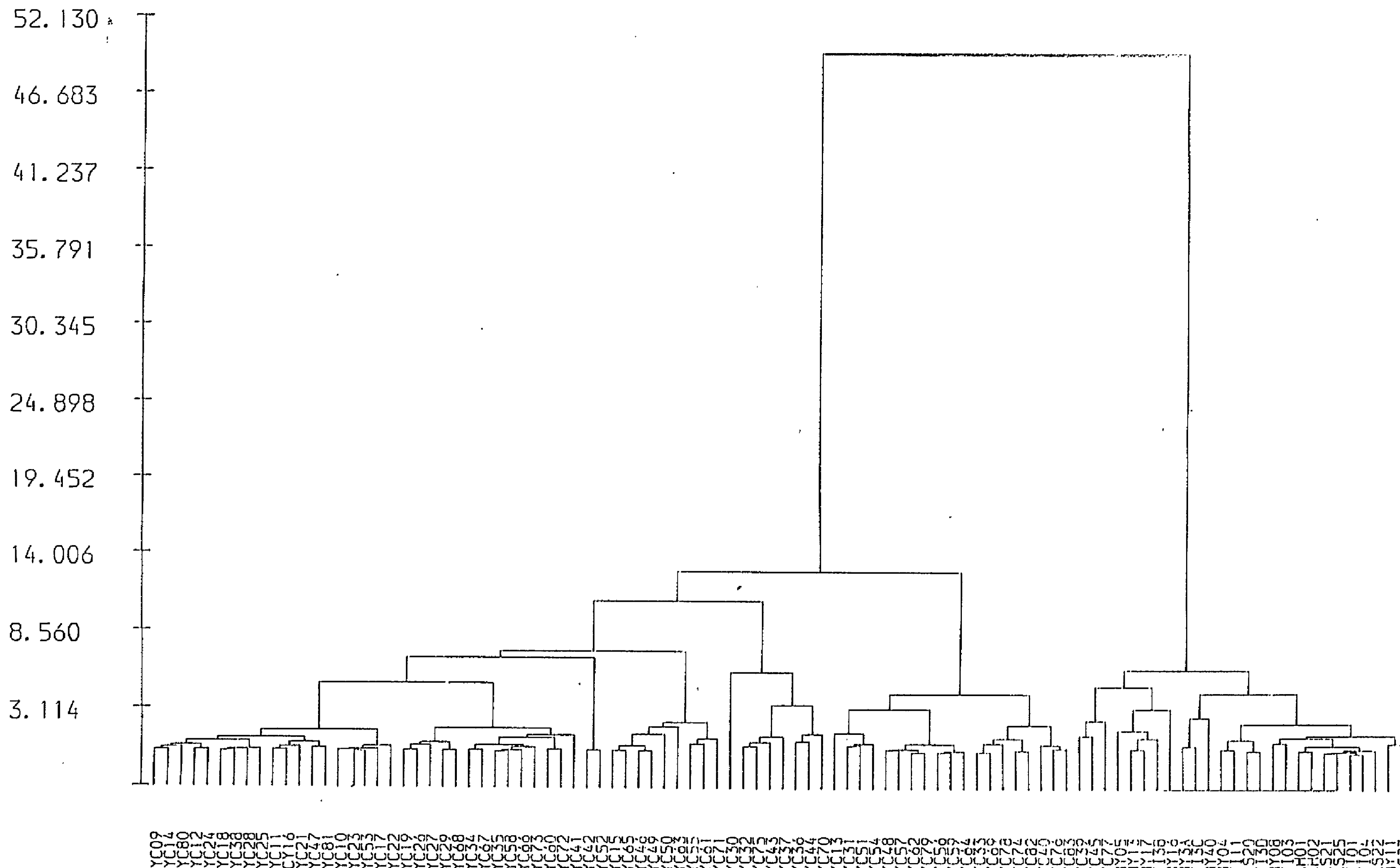
D8: Olympia, (OLY), Provenance.



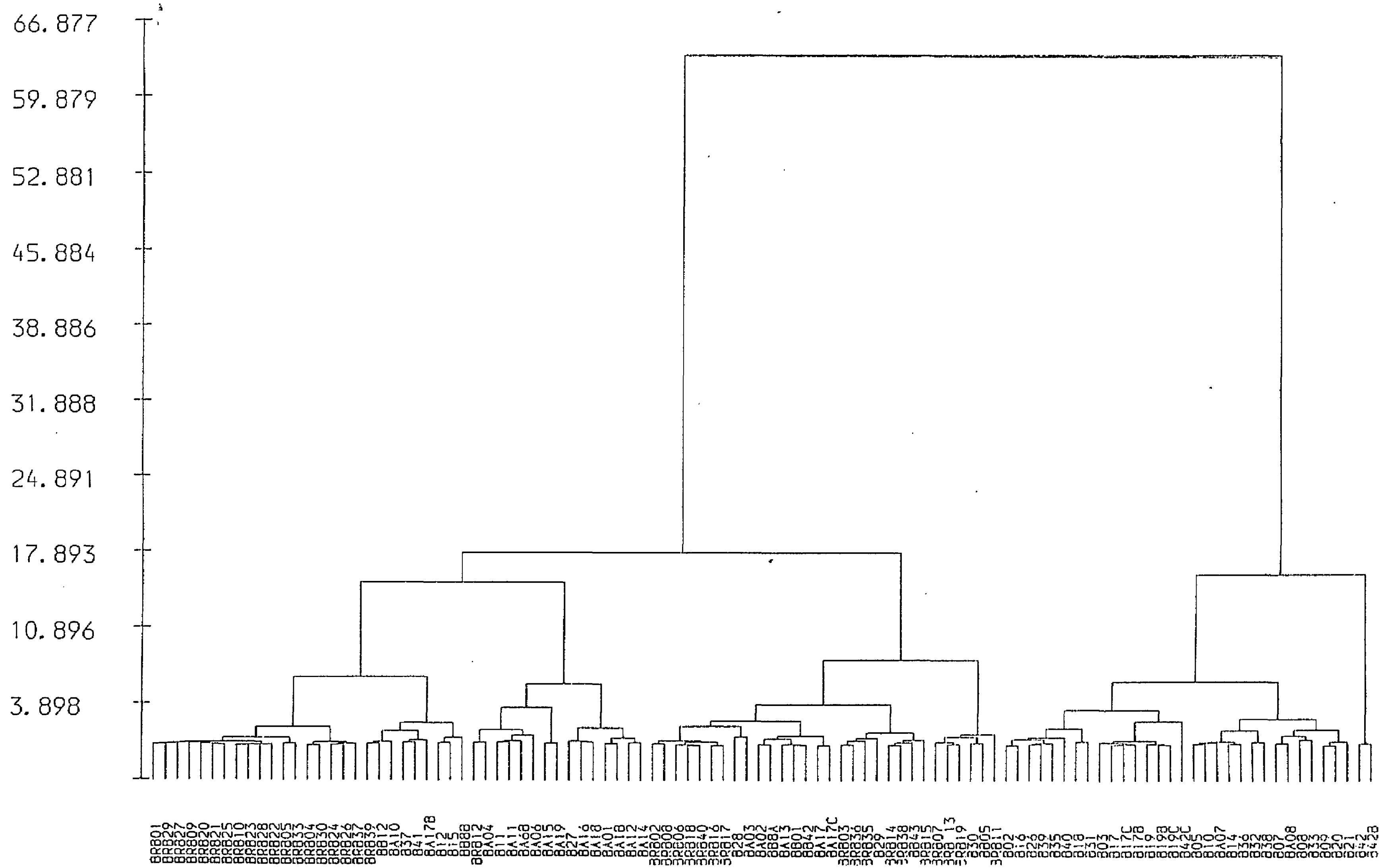
D9: Nemea, (NEM), Provenance.



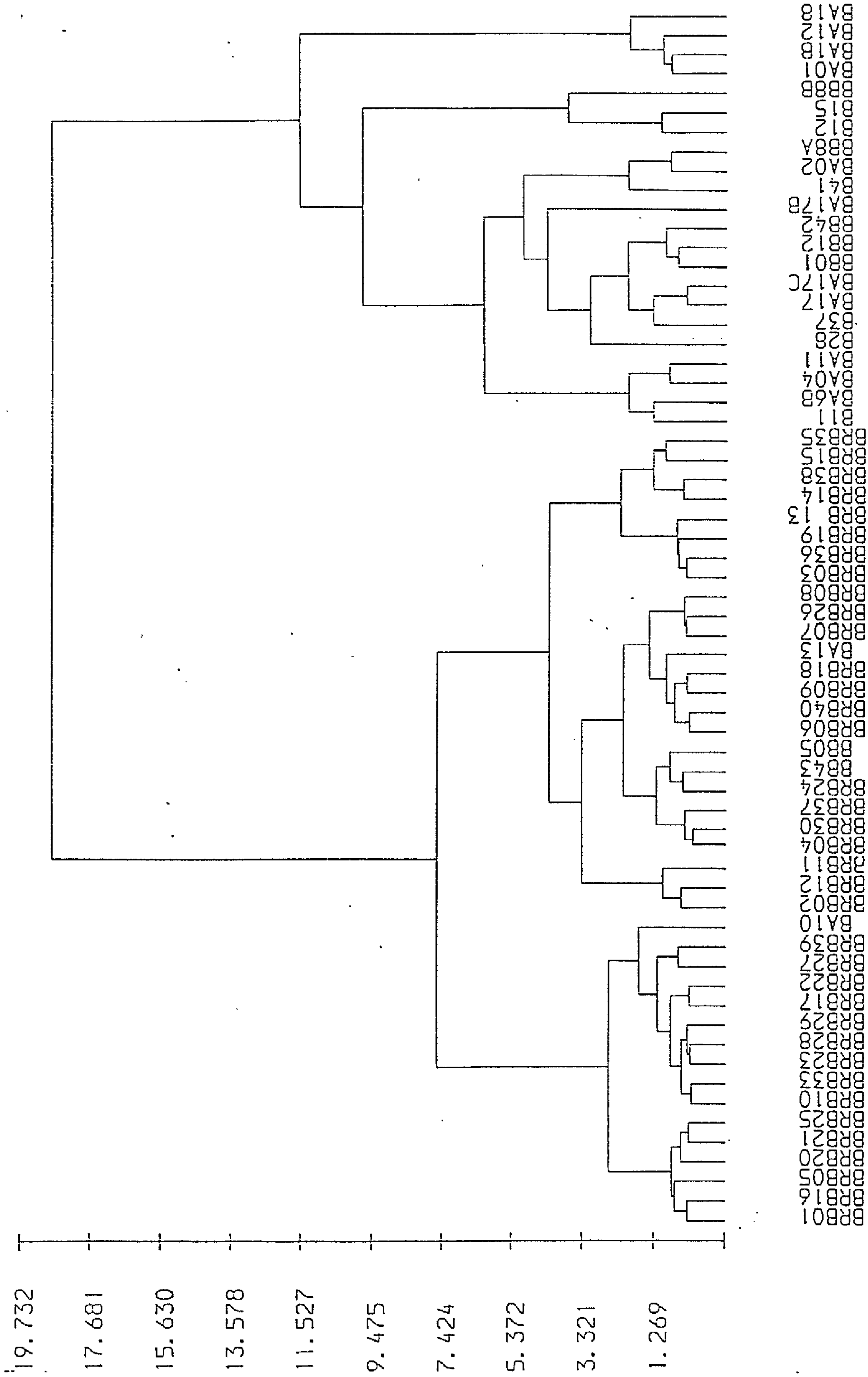
D10: Mycenae LBA, (MYC), Argive Geometric, (MY) and Black Glaze, (JMYC).



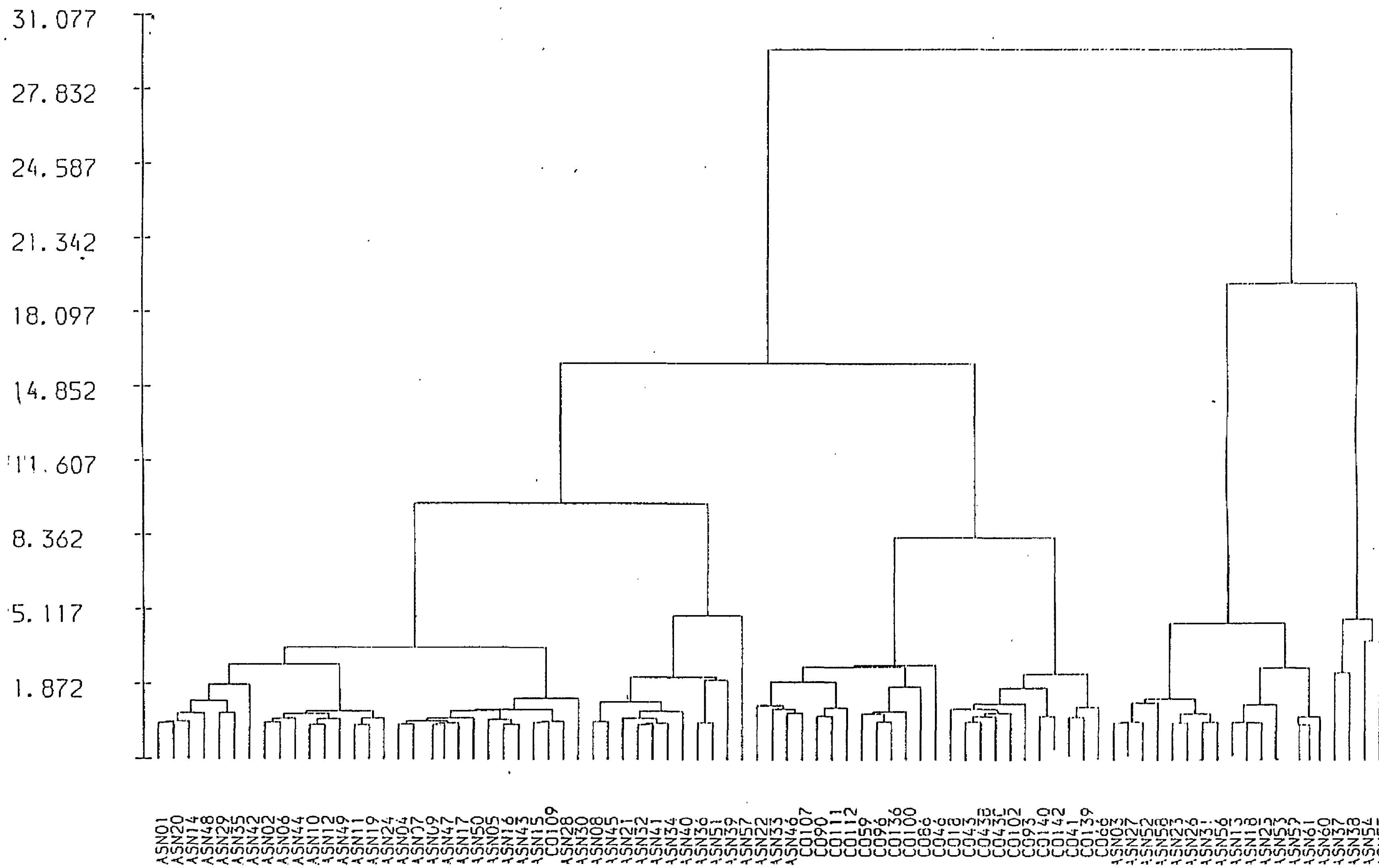
D11: Mycenae LBA, AG and BG, (Dilution Corrected).



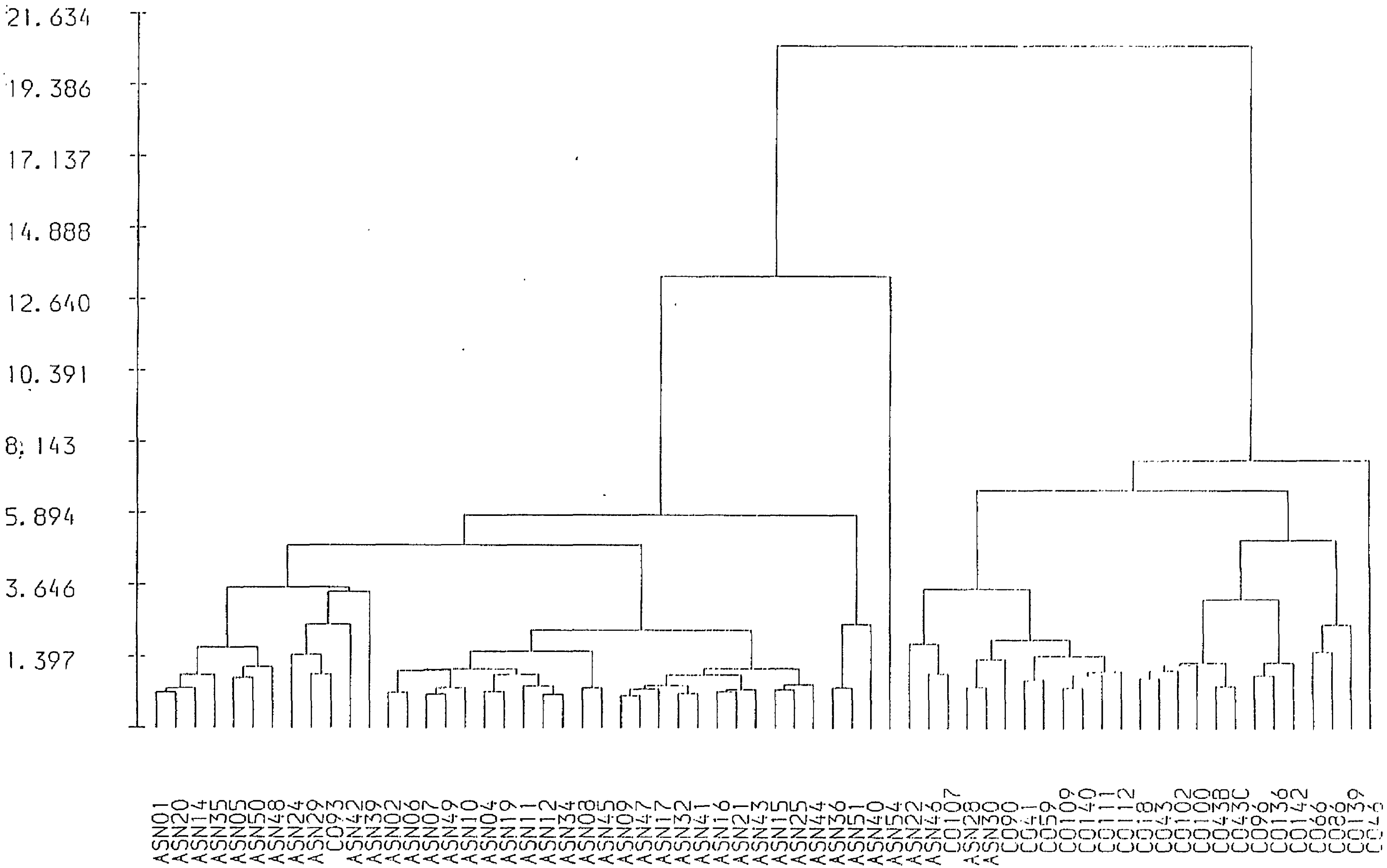
D12: Berbati Late Bronze Age, (BERB), and Black Glaze, (B/BA), Sherds.



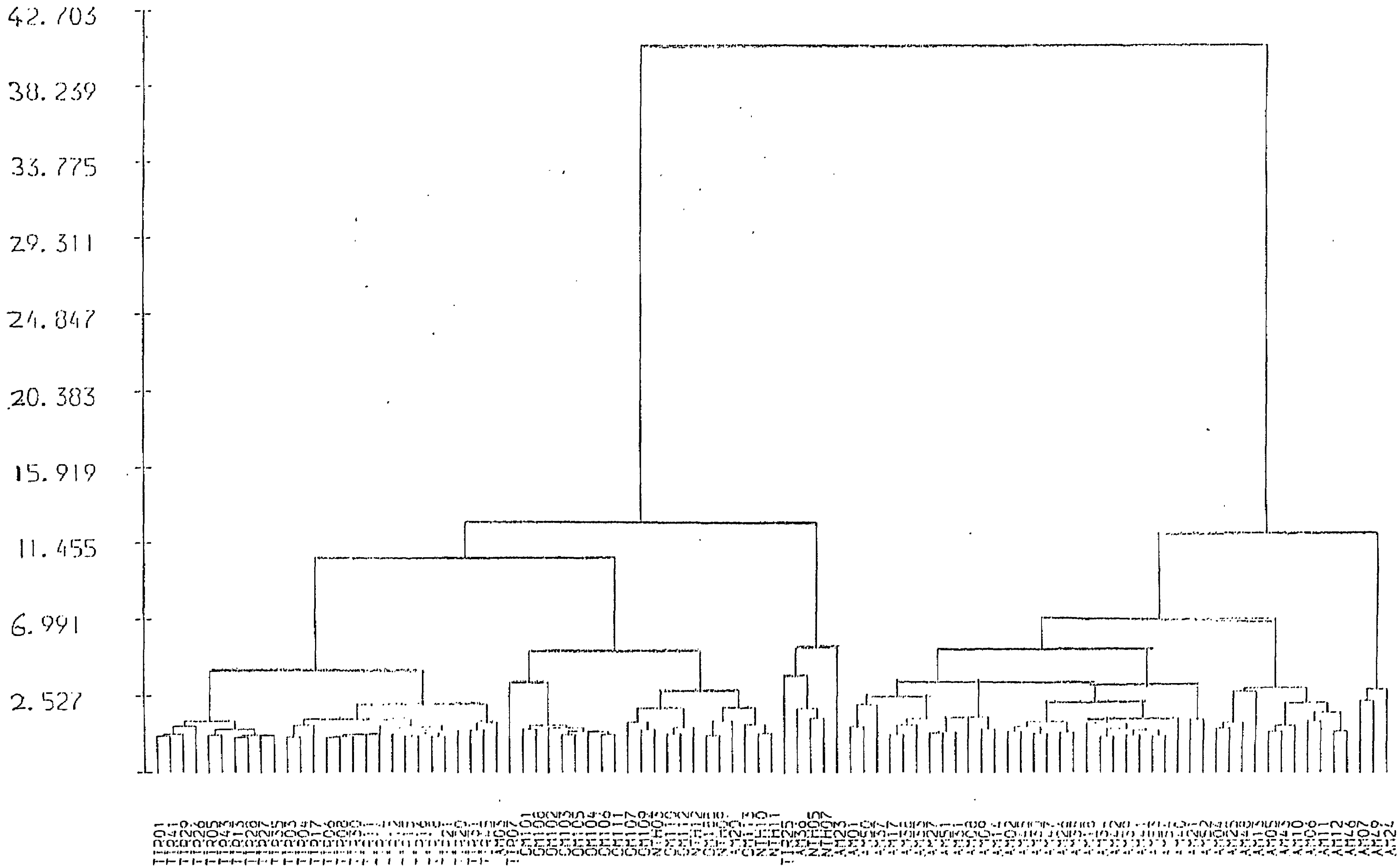
D13: Berbati LBA and BG, (Dilution Corrected).



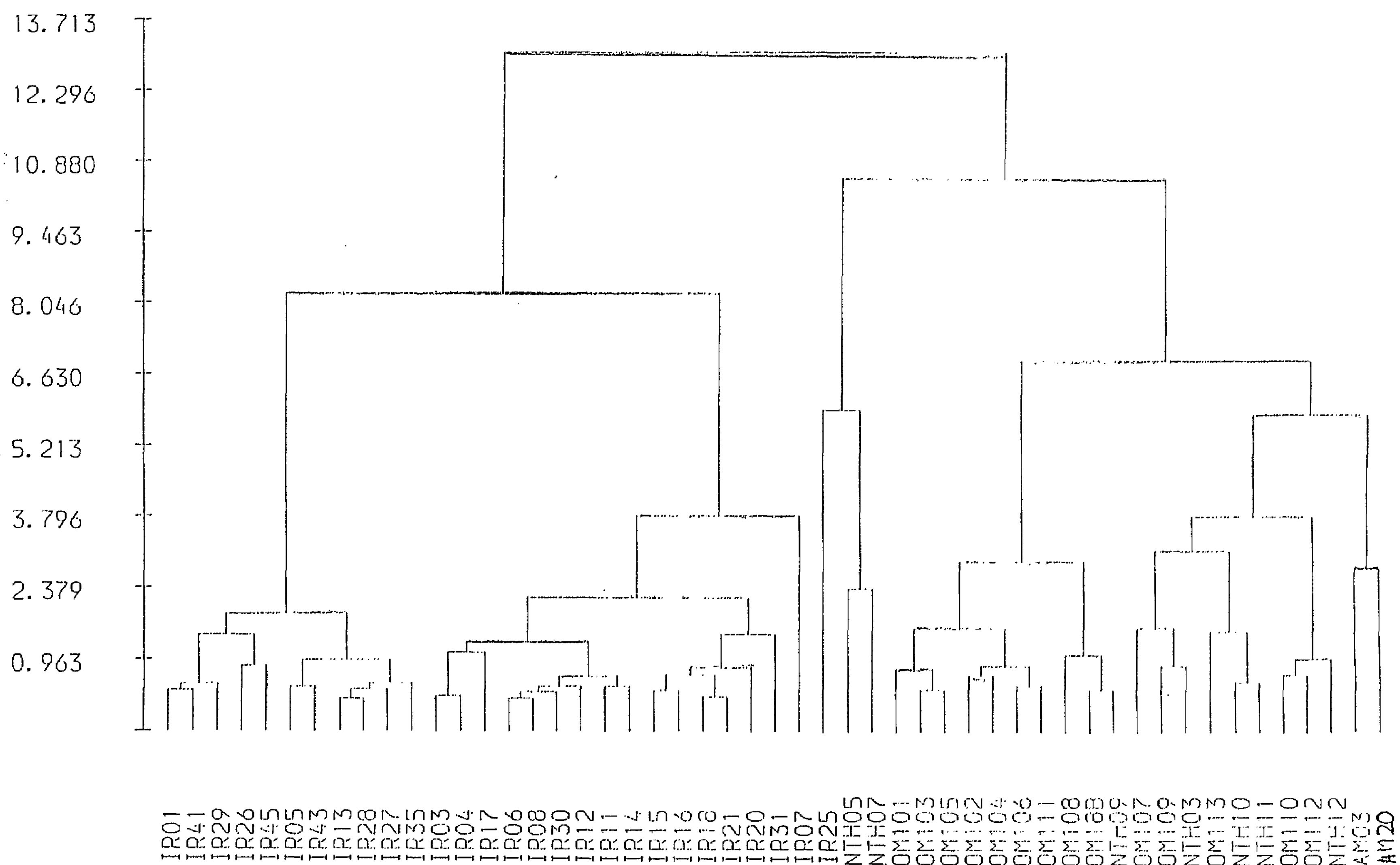
D14: Asine Late Bronze Age, (ASN), and Corinth, (CO).



D15: Asine Late Bronze Age and Corinth, (Dilution Corrected).



D16: Tiryns LBA, (TIR), Argive, (AM) and Corinthian HW, (NTH/OM1), (Dilution Corrected).



D17: Tiryns LBA, (TIR) and Corinthian Handmade Wares, (Dilution Corrected).

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