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A landmark for local communities. Compositional analysis of the early Iron Age sanctuary at Polizzello Mountain (Sicily, Italy)

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ABSTRACT

With this study we provide the compositional characterization of archaeological ceramics from the earliest phases of the indigenous sanctuary located on top of Polizzello Mountain, in Central Sicily (Italy). The site represents a remarkable evidence of the Late Bronze Age (LBA) - Early Iron Age (EIA) transition on the island, and it is characterized by the striking occurrence of material offerings in the form of ritually fragmented and highly standardized objects. The presence of multiple structures and the frequent evidence of dining activities, has led to the idea that the hilltop represented an important landmark for local indigenous communities across the landscape of Central Sicily. To test such hypothesis, bulk compositional analysis was used for the ceramics from the EIA levels of the sanctuary at Polizzello Mountain. Sixty-eight diagnostic specimens were analyzed via Instrumental Neutron Activation Analysis (INAA) to discriminate among distinct pottery groups according to the composition of their paste. The outcomes show little but clear compositional variations between three main pottery groups, which likely reflect the geographic background of the communities gathering at the sanctuary.

1. Introduction

The study of ceramic technology can inform about meaningful aspects of ancient societies. In pottery studies, such technological features include the material evidence of the raw materials used, the paste preparation, tempering, forming and firing techniques, which are all clues in regards to the definition of a proper set of manufacturing techniques in a given culture (Eckert et al., 2015; Sillar and Tite, 2000). Among the many different approaches used in archaeology for pottery studies (Hunt, 2017), compositional analysis is often used to explore the chemical fingerprints of archaeological pottery (Glascock and Neff, 2003).

In this study, the focus is to explore the compositional variations of pottery types that diagnostically mark the Late Bronze Age (LBA: ca. 1250 – 1050 BCE) and the Early Iron Age (EIA: ca. 1050 – 850 BCE) transition across Central Sicily, and that best represent the earliest phases of use of the sanctuary at Polizzello Mountain (Fig. 1). By doing so, we test if the bulk of ceramic samples display overall meaningful differences reflecting the raw materials used for pottery manufacturing.

The interpretation of the site as a sanctuary (Panvini et al., 2009) resulted from the evaluation of the archaeological evidence from the northern side of the plateau located in Central Sicily, characterized by several rock structures arranged in a spatial and temporal association, and by the presence of many offering pits across the ground floors. Throughout this large area marked by invasive anthropogenic activities, several broken artifacts, including pottery, were found. The unusual and uncommon combination of all these features on top of a hill in the Upper Platani Valley has led to the idea that the site was an important landmark in the core of Sicily, where the indigenous communities could gather altogether to perform specific activities. The occurrence of long-lasting ceramic typologies, repetitive decorative patterns, and a standardized set of activities carried out through time across the plateau were considered the baseline for an archaeometric inquiry focused on the discrimination between compositionally different groups of ceramics.

1.1. Geomorphology of the Platani Valley

The site is located in the core of Central Sicily, on top of a hill along the Upper Platani valley, which includes both the province of Agrigento and Caltanissetta, and that is traditionally referred to as *Sikania*, as it was described first by ancient sources (Sammartano, 1998). This area

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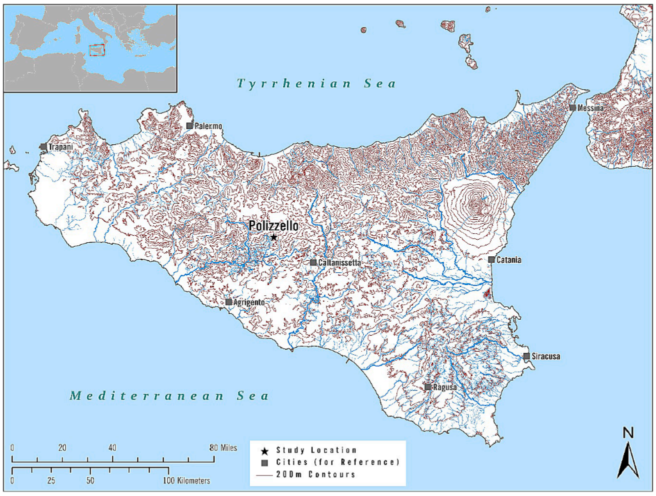

Fig. 1. Contour map of Sicily, showing its location across the Mediterranean, and the location of Mount Polizzello in the central part of the Upper Platani Valley.

was home to the earliest indigenous groups of Sicily, named Sikanians, whose historical developments have been widely discussed through the archaeological research (Spatafora and Vassallo, 2002). The lithostratigraphic scheme referred to in this study is taken by Antonioli et al. (2006). The landscape of the Platani basin is characterized by the Messinian evaporites, which originated from the salinity crisis that affected the entire Mediterranean area between 6 and 5 mya.

Evaporite deposits are widespread throughout Central Sicily and are distributed in the two major areas of Caltanissetta-Enna and Agrigento (Fig. 2). Upper Messinian deposits consist of calcarenite, clays and grey or red-brown marls, and poorly cemented quartz-micaceous sandstone. Above this layer, a mixture of sandy clays (mainly silica and feldspars) and different types of sands form more recent geological contexts, which can be usually found at the bottom of many carbonate rock cliffs, especially in the north, alongside the Numidian flysch formation. The most recent Upper Pliocene-Pleistocene deposits (5–2.5 mya) consist of clastic and clastic-carbonate units. Other sedimentary components often found with the evaporitic sequences are selenitic gypsum and salt deposits (Basilone, 2018).

Within this geological setting, Polizzello represents a crucial landmark in the Upper Platani Valley for its position in the landscape, where the geology displays overall standardized features across a very wide geographic area, stretching between the provinces of Caltanissetta and Agrigento for almost 100 km, north to south. We considered the upper portion of the Platani valley, which is characterized by the occurrence of prehistoric archaeological evidence consistently marked by a high homogeneity of pottery forms, shapes, types, and decorative patterns, especially between the Bronze and the Iron Age.

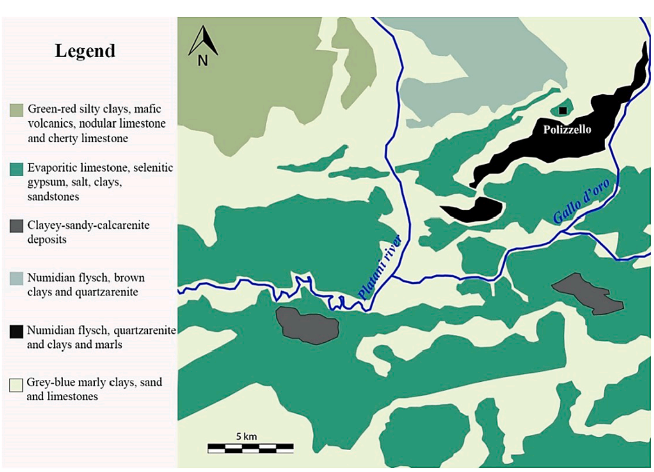

Fig. 2. Schematic representation of the most common Pleistocene geological formations across the upper Platani Valley.

1.2. *Sicily during the LBA-EIA*

The current status of the archaeological practice has seen an increasing in archaeometric studies across the island. However, wider interdisciplinary anthropological projects are, overall, still missing (Doonan, 2001; Gliozzo et al., 2008; Kolb and Tusa, 2001). Indicative of such a trend is the overall absence of radiocarbon dates for the LBA-EIA transition across the island (Bietti Sestieri, 2015; Iacono et al., 2021; Tusa, 1994). In the last few decades, several archaeometric investigations were carried out across the island in order to understand the complexity of local pottery manufacturing (Barone et al., 2005; Montana et al., 2020; 2012; Raneri et al., 2015; Tanasi et al., 2019), the characteristics of specific productions (Barone et al., 2014; Copat, 2020; Kolb and Speakman, 2004; Rodrıguez et al., 2015), and the provenance of the artifacts (Barone et al., 2015; 2012; 2010; Mentesana et al., 2018; Montana et al., 2013), but no regional study of the Platani Valley in central Sicily has been attempted yet.

The archaeological information available for the Bronze Age of the island suggests that Sicily was at the core of several intricate maritime networks involving the interaction with many agents across the Mediterranean (Leighton, 1999; Tanasi, 2020). Several socio-cultural practices, other than consuming the same products, were broadly known and shared across different regions throughout the sea, and within Sicily. Here, the local social texture of the Platani Valley seems to express its cultural features through a complex system aimed at promoting overall unifying cultural models, while slowly incorporating foreign attributes (i.e. Aegean and Levantine ceramic types). This scenario properly fits the idea of a broader population sharing a solid cultural background, and interacting with other peripheral entities, especially along the northwestern and the southeastern coasts. However, between the LBA and the EIA major political events deeply affected Sicily (Leighton, 2011; Palermo, 2012), and the archaeological record testifies new local trends in pottery production, with ceramics in the style of North Pantalica earlier (ca. 1250 – 1050 BCE), and Cassibile later (ca. 1050 – 850 BCE), which clearly represent the most diagnostic element of such processes (Bietti Sestieri, 2015). The summary of this chronological scheme adopted in the current study is provided in Table 1.

2. The archaeological evidence at Polizzello Mountain

2.1. *The so-called acropolis of Polizzello Mountain*

Originally (De Miro, 1988), the site of Polizzello Mountain was known for the presence of a complex archaeological evidence (Fig. 3).

Table 1
Chronological framework adopted for the Bronze Age and Iron Age of Sicily (after Tanasi 2012).

Estimated date	Phase	Chronology	Label	Aegean chronology
ca. 1440–1300 BCE	Thapsos	Middle Bronze Age	MBA	LHIIA-LHIIIB
ca. 1270–1050 BCE	North Pantalica	Late Bronze Age	LBA	LHIIIB-Sub Mycenaean
ca. 1050–850 BCE	Cassibile	Early Iron Age	EIA	Protogeometric-EG
ca. 850–750 BCE	Sant'Angelo Muxaro-Polizzello	Iron Age	IA	MG-LG

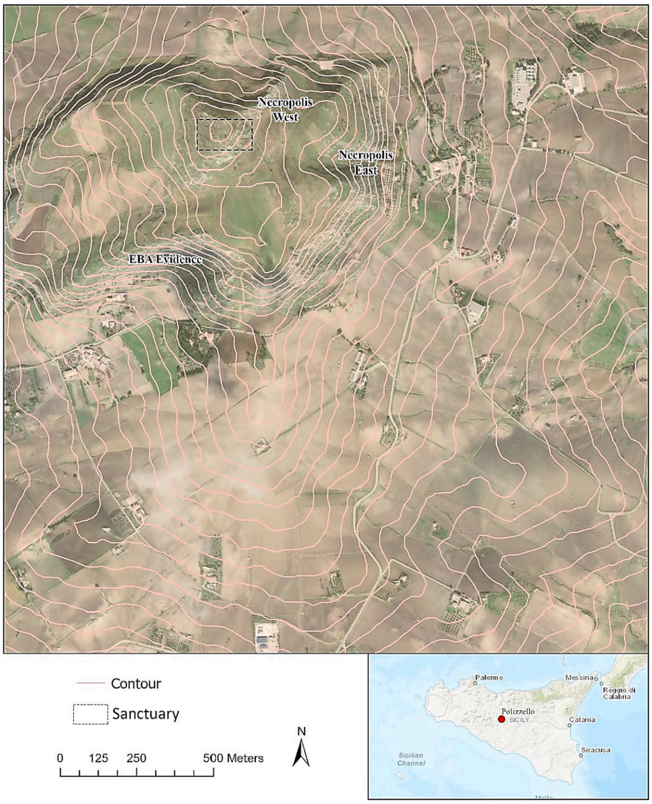

Fig. 3. Map of Polizzello Mountain, showing the location of the prehistoric sanctuary and the distribution of the other archaeological evidence across the plateau. On the bottom right, a map of Sicily shows the location of the site across the island.

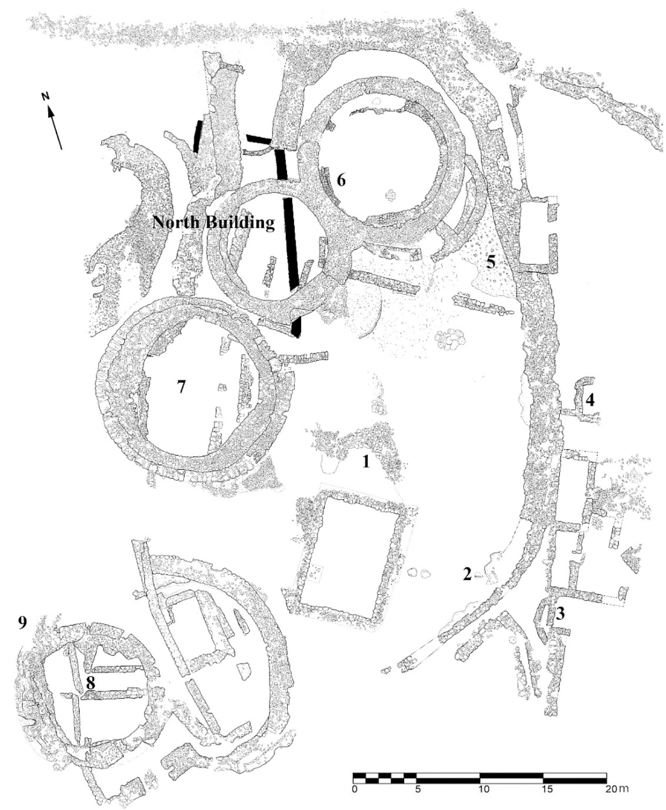

Fig. 4. Map of the northern side of the plateau, showing the extension and the structural settings of the prehistoric sanctuary on top of Polizzello Mountain (after Tanasi 2012).

On the eastern side, two small clusters of rock-cut tombs (East and West) were built around a small settlement, while a communal area (named "*acropolis*") marked by the presence of ritual activities was located on the upper portion of the mountain. Similar indigenous upland sites of western Sicily, such as Sabucina, Monte Polizzo and Colle Madore, show very similar features, especially for the clear evidence of communal feasting activities (Ferrer, 2013), and the trend seems to be related to a broadly Mediterranean practice (Hamilakis, 2012; Iacono, 2015).

What makes the evidence on top of the Polizzello Mountain unique is the consistent presence, across several chronological phases (from the half of the 10th to the first half of the 8th century BCE: Tanasi, 2007; 2009; 2012), of various goods of Aegean and Levantine type earleir, and of Greek and Phoenician type later, along with indigenous pottery traditionally non-Sikanian. The strong ritualistic connotation of the site is the main reason for its interpretation as a Sikanian sanctuary (Palermo, 1981; 2008).

2.2. *The indigenous sanctuary*

The most recent archaeological investigations were carried out between 2000 and 2006 (Panvini et al., 2009). Nine sectors of the site dated to the (LBA-EIA) were identified as 'contexts' and numbered from 1 to 9 (Fig. 4). Most of the ceramic materials included large fragments of open shapes (amphorae, pedestal basins, bowls, jugs) and consumption vessels (cups and pedestal cups), either undecorated or bearing a red or a dark surface with incised, burnished, or slipped decoration typical of several Sicilian contexts from the LBA and EIA (Tanasi, 2012). Prior to this study, no broad archaeometric investigation had been carried out on ceramic assemblages from the sanctuary, with the exception of a preliminary non-destructive investigation of the red slipped pottery class (Pappalardo et al., 2008) from the Archaic phase of the sanctuary.

The core of the evidence accounting for the EIA phases comes from the so-called North Building. The structure displays linear stone walls and separate rooms where, among many artifacts, several broken EIA ceramics in the style of Cassibile and Sant'Angelo Muxaro-Polizzello were recovered (Tanasi, 2009; 2012). Perhaps, the most diagnostic feature of the North Building is one the buried deposit (Dep. 2) found across the lowest layer of the structure, which includes different broken shards of large containers decorated with incised lines and painted patterns proper of the local EIA tradition (Fig. 5). This specific activity

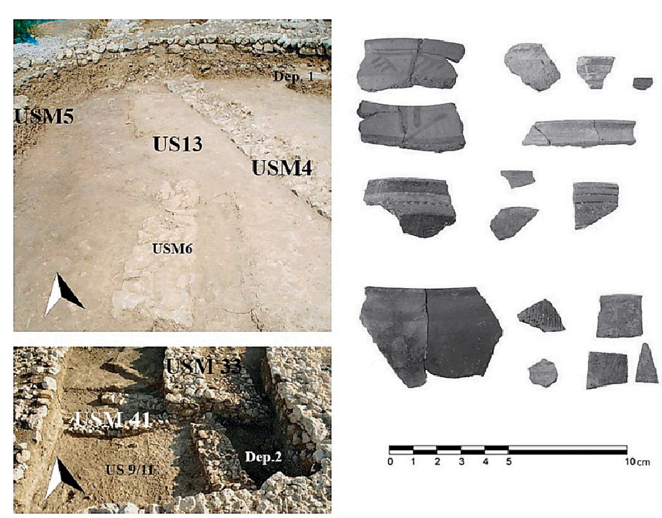

Fig. 5. Photo detail of US13 (top, modified from Tanasi (2009), Fig. 16, p. 15), and US9/11 (bottom, modified from Tanasi (2009), Fig. 24, p. 19) in relation to Dep.2 across the North Building, along with some of the diagnostic pottery.

has several parallels with the broader Mediterranean world, especially in the Eastern Mediterranean and the Aegean (Renfrew et al., 2012).

Similarly, other surrounding structures and major features display traces of anthropogenic disturbance due to the continuous architectural renovation of the area. Within Context 1, below a layer of mixed soil, animal bones, ashes, charcoal, and burnt material, a votive pit labeled "Bothros 2" including several broken ceramic containers, such as decorated (red or dark and burnished slip, incisions) and undecorated amphorae, cups, and pedestal basins conventionally dated to the EIA were recovered.

Not far from Context 1, Context 2, which displays a very similar ceramic assemblage, shows markers of a large destruction event that also affected Contexts 3 and 4 around the same time (EIA, according to ceramic typologies). Context 5 refers to a consistent deposit of animal bones and a structural collapse obliterating a layer where several EIA ceramic shards were found, while Contexts 6 through 9 have been heavily renovated across the centuries. Their archaeological assemblages are very heterogeneous, including sporadic EIA ceramic shards in the so-called style of Cassibile and Sant'Angelo Muxaro-Polizzello.

2.3. The study

Since very little is known about the social aspects of the prehistoric communities of Sicily, our goal is to analyze the elemental composition of local archaeological pottery, thus discriminating between compositionally different groups of ceramics, in order to test whether the sanctuary represented a landmark for the communities living across the Upper Platani Valley. Given such premises, the high accuracy of the INAA represents a great compromise between the archaeological context available and the qualitatively known geological context.

While the absence of quantitative information in regards to local clay sources and the technology of pottery manufacturing limit the resulting interpretation, such a gap does not affect the importance of the study, since the dataset has the potential to offer an accurate baseline for future research across much larger landscape (Mommsen et al., 2006; Montana et al., 2003; Kolb and Speakman, 2004; Riehle et al., 2021). The results here provided represent an extract from a wider doctoral project (Caso, 2020) focused on the LBA-EIA archaeological contexts of Central Sicily, with a major emphasis on the interpretation of the overall chemical background of the archaeological context.

3. Materials and methods

3.1. Compositional analysis

Instrumental Neutron Activation Analysis (INAA) is a nuclear process for determining the elemental composition of ceramics, clay, and other materials at the percent, parts-per-million (ppm), and even parts-per-billion (ppb) level (Glascock, 1992). Reference groups, or compositional groups, of ceramics are identified based on similarities and differences in element concentrations or element ratios. While INAA by itself cannot reveal the full spectrum of information about the technological aspect of pottery production *per se*, it can still be an important analytical tool to discriminate between pottery with similar chemical fingerprints (Glascock and Neff, 2003). If no comparative material exists, then the criterion of "local abundance" suggests that the most abundant pottery at a given context can be considered as local, namely locally used (Hunt, 2017).

Statistics is, then, used to allow the investigation and the characterization of groups of specimens. This step includes the testing the occurrence of internal consistencies via hierarchical cluster analysis, along with the principal component analysis (Malainey, 2011). There are difficulties inherent in working with pottery, but the approach outlined earlier is potentially capable of overcoming some of the problems and providing useful insights into regional variations (Baxter et al., 2008), and thus it fits the purpose of this study.

3.2. Ceramic sampling

The sampling was carried out at the Antiquarium of Mussomeli (Caltanissetta, Sicily) in 2019. A total of 68 ceramic containers were sampled according to their typology and fabric (Tanasi, 2012). The size of the selected pottery fragments ranges from about 2 to 4 cm^2. All the ceramic samples fit the relative chrono-typological framework adopted for Central Sicily. Diagnostic pottery was sampled from Contexts 1 through 9, including Context 3 and 4 (respectively Hut 1 and Hut 2), and the North Building. Amphorae (n = 3), open-shaped large containers (n = 3), a chalice (n = 1), one undecorated bowls (n = 1), and several ceramic pedestals (n = 6) represent minor components of the ceramic assemblage. More common ceramic containers include *askoi* (n = 3), *oinochoai* (n = 2), *pyxis* (n = 3), and cooking pots (n = 4). The most diagnostic ceramic markers of the earliest phases of activity at the sanctuary, however, are represented by the cups (Fig. 6), including decorated (n = 26) and undecorated types (n = 6). Along with cups, pedestal basins are the most frequent ceramic type recorded at the site (Fig. 7), occurring as the decorated types with linear incisions (n = 4), and with either painted surface (n = 2) or slipped and burnished surface (n = 3). Only one undecorated pedestal basin (n = 1) was sampled, while uncommon ceramic pots are very rare (Fig. 8). The full list of samples, including context, relative chronology, and description, is provided in Appendix A.1.

3.3. INAA and compositional analysis

The samples were then cataloged and sent to the Archaeometry Laboratory at the University of Missouri Research Reactor for the compositional study. Here, the samples were cleaned carefully to remove any potential soil contamination. Then, they were powdered with an agate mortar and pestle to a mass of 200–500 mg, and placed in clean vials of high-purity polyethylene. Both the short and the long irradiation procedures were considered the best candidates to obtain the chemical fingerprints of the samples. The INAA procedures at MURR consist of two irradiation cycles and three gamma counts total. A short irradiation is carried out for five seconds at a neutron flux of 8 × 1013 cm^2/1s. This procedure (720-second count) yields peaks for nine short-lived elements (Al, Ba, Ca, Dy, K, Mn, Na, Ti, V). The longer irradiation consists of a 24-hour irradiation at a neutron flux of 5 × 1013 cm-2 s-1. After seven days, samples decay and measurements (1800-second count) for medium half-life elements (As, La, Lu, Nd, Sm, U, Yb) were performed. After an additional three- or four-week decay, long half-life element analysis (Ce, Co, Cr, Cs, Eu, Fe, Hf, Ni, Rb, Sb, Sc, Sr, Ta, Tb, Th, Zn, Zr) was carried out on each sample (9000-second count). All data reductions are based on current consensus element libraries for the standards, as published by the Missouri University Research Reactor

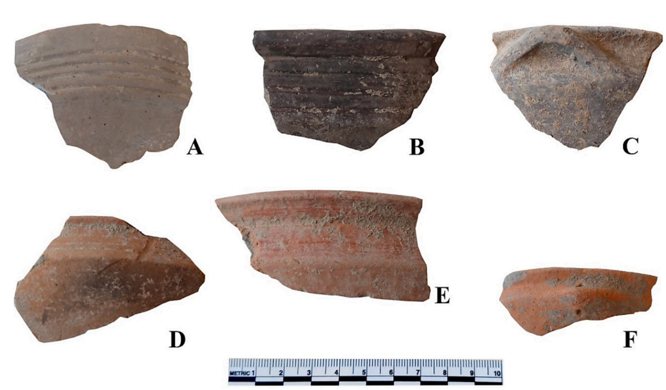

Fig. 6. Examples of recurring forms of the cup type from the indigenous sanctuary at Polizzello Mountain: A) incised cup 39063; B) incised cup 39102; C) painted cup 39108; D) red slipped incised cup 39017: E) red slipped and burnished cup 39096; F) undecorated cup 39053.

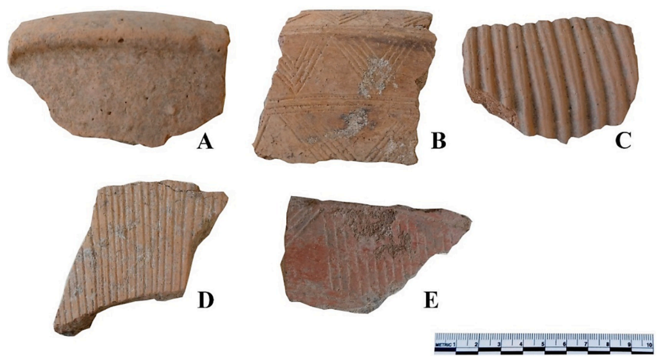

Fig. 7. Examples of recurring forms of the decorated pedestal basin type from the indigenous sanctuary at Polizzello Mountain: A) painted pedestal basin 39066; B) incised pedestal basin 39117; C) incised pedestal basin 39116; D) incised pedestal basin 39115; E) red slipped and burnished incised pedestal basin 39188.

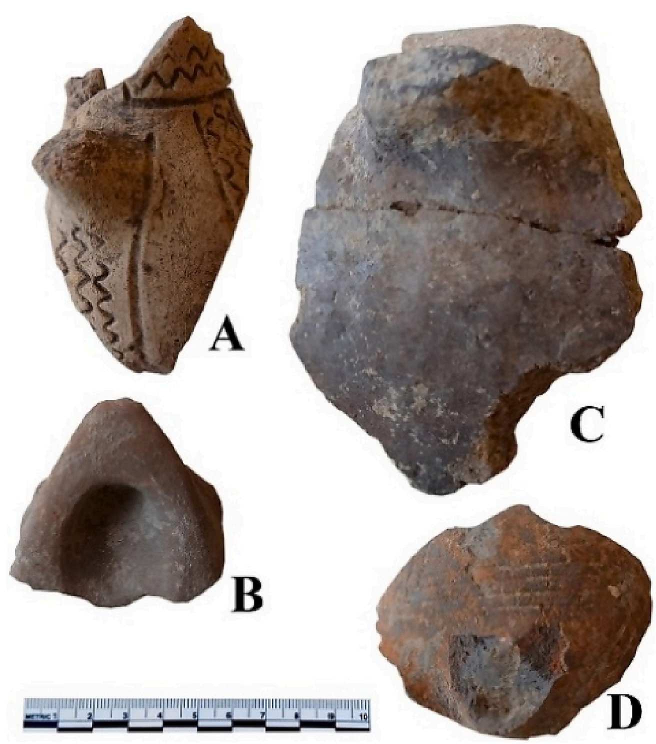

Fig. 8. Examples of uncommon pottery types from the indigenous sanctuary at Polizzello Mountain: A) incised jug 39092; B) undecorated amphora 39101; C) cooking pot 39057; D) incised pyxis 39084.

(Glascock and Neff, 2003). The resulting element concentrations were converted and reported in log base 10 values for quantitative analyses. The table included in Appendix A.2 displays the full list of the raw data (ppm) for each variable.

4. Results

4.1. Multivariate statistical analysis

As the descriptive statistics shows (Appendix A.3), the dataset includes missing values in five cases (n = 63/68) for Ni (s = 0.12), and in one case (n = 67/68) for K (s = 0.06) and (n = 67/68) Ti (s = 0.04) (Table 2A). Sometimes, elemental concentrations can fall below the detection limits of the instrument, thus resulting in the occurrence of missing values, such as for Ni, K, and Ti in our dataset. Hence, in order to avoid computational biases, they were removed during the following statistical analysis. Among all the variables, Fe (4.73), Al (5.02), Ca (5.41), and K (4.44) are listed as the elements with the highest concentration (Table 2B).

Table 2A
Descriptive statistics of Ni, K, and Ti bearing missing values in the original dataset.

Variable	N	Min	Max	Mean	SD
Ni	63	1.33	1.91	1.64	0.12
K	67	4.15	4.44	4.33	0.06
Ti	67	3.53	3.78	3.70	0.04

Such overall picture allowed us to classify the samples by the means of hierarchical cluster analysis, which was performed according to the Ward's method and via squared Euclidean measures (Fig. 9). Three main clusters and one outlier making up a group by its own (39091) were identified. The resulting artificial classification includes ChemGrp 1 (n = 19), ChemGrp 2 (n = 35), ChemGrp 3 (n-=13) and ChemGrp 4 (n = 1). Since the distances between cases are not significantly large, the outlier was kept for further testing. The groups identified by the hierarchical cluster analysis were assigned to specimens in the dataset accordingly. The resulting Shapiro's test for normality (Table 3) showed how values for As, Sb, Sr, Tb, Zr, and Na are normally distributed ($p > .05$), while the majority of the dataset is below the alpha level of 0.05 (Appendix B.1). The groups were furthermore confirmed via discriminant function analysis by using Malahnobis Distance group membership probability scores (Table 4).

The following step included factor analysis. The KMO's and Bartlett's tests both provided significant results (Table 5). The former scored a higher value ($P = 0.882$) than the required standard, while the latter confirmed the statistical significance of the extraction ($p < 0.001$). Only the first two components were kept, each accounting respectively for 43.11% and 23.10%, up to a total variance explained of 66.213% (Table 6).

The following table (Table 7) accounting for the component matrix shows how the overall scores are still considerably low. Among all the variables (Appendix B.2), the variances associated with Na (0.153) scored the highest amount for the extraction of Component 1, while Sr (0.346), and Ba (0.532) bore the highest value among the loadings for Component 2.

A final scatter plot displaying PC1 and PC2 showed a distribution pattern characterized by three small groups (ChemGrp) of cases that are closely clustered to each other (Fig. 10), while the outlier is isolated far from the core cluster.

4.2. Discussion of the compositional variation

Archaeological ceramics analyzed via INAA are characterized by a higher concentration of Fe, Ca, and K, which are all crucial elements within the clay. Three major groups and one outlier were recorded according to both the hierarchical cluster and factor analysis. ChempGrp 2 represents the largest cluster (n = 37) and it indiscriminately includes different ceramic types, although cups dominate the record. ChemGrp 3 is the smallest one (n = 12), and, as well as ChemGrp 2, seems to include different ceramic typologies altogether. ChemGrp 1 (n = 18), on the other hand, includes mainly common ware for food and beverage

Table 2B
Descriptive statistics of elements bearing the highest concentration across the dataset.

Variable	N	Min	Max	Mean	SD
Fe	68	4.57	4.73	4.69	0.03
Al	68	4.50	5.02	4.95	0.06
Ca	68	4.54	5.41	4.76	0.14
K	67	4.15	4.44	4.33	0.06

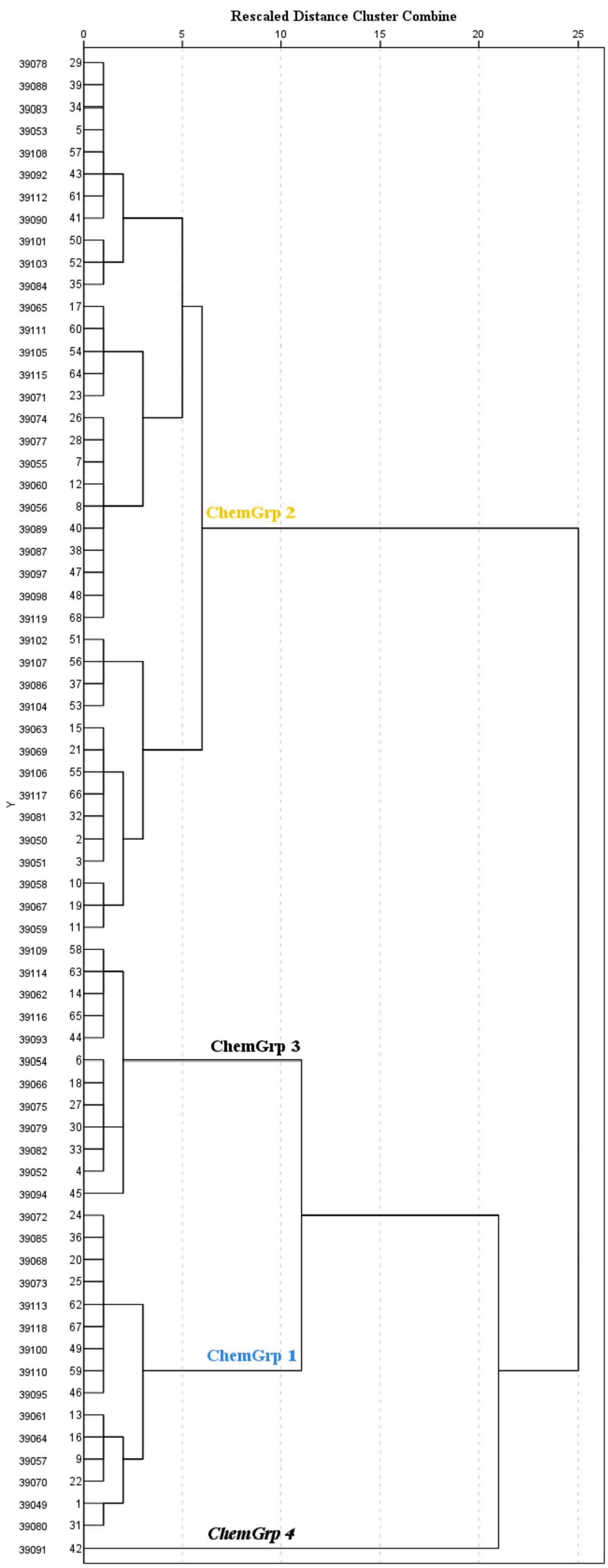

Fig. 9. Dendogram resulting from the hierarchical cluster analysis of the dataset, whose clustering discrimination is highlighted by the labels, with relative ID numbers, accounting for each group (ChemGrp#).

Table 3
Results of the Shapiro's-Wilk's test of normality, showing the variables bearing normally distributed values.

Shapiro-Wilk			
Variable	Statistic	df	Sig.
As	0.981	68	0.385
Sb	0.970	68	0.095
Sr	0.980	68	0.326
Tb	0.976	68	0.222
Zr	0.990	68	0.859
Na	0.974	68	0.174

Table 4
Probability scores accounting for group membership resulting from the discriminant function analysis by using Malahnobis Distance.

	ChemGrp	1	2	3	4	Total
Count	*1*	18	0	0	0	18
	2	1	35	1	0	37
	3	0	0	12	0	12
	4	0	0	0	1	1
%	*1*	100	0	0	0	100
	2	2.7	94.6	2.7	0	100
	3	0	0	100	0	100
	4	0	0	0	100	100

Table 5
Results of the KMO and Bartlett's Test for sample size adequacy and extraction significance.

Kaiser-Meyer-Olkin Sampling Adequacy.		0.882
Bartlett's Test	Chi-Square	3490.566
	df	435
	Sig.	0.000

Table 6
Results of the component extraction for factor analysis.

Component	Extraction Loading		
	Total	% Variance	% Cumulative
1	0.120	43.111	43.111
2	0.065	23.102	66.213
3	0.035	12.547	78.760

Table 7
Loading scores accounting for the variables Sr, Ba, and Na.

	Component	
Variable	1	2
Sr	−0.176	0.346
Ba	−0.227	0.532
Na	0.153	

processing and/or serving, while sample 39,091 (painted cup) represents the only outlier and, therefore, it was assigned to ChemGrp 4 by itself. The detailed lists including the specimens accounting for each of the ChemGrp are included in Appendix C.1.

However, the overall low compositional variation suggests that the groups slightly differ from each other, without any specific pattern. In fact, if the same samples are scattered according to the weighted ratios of Ba\Na (Fig. 11), their discrimination into three groups becomes less clear, as the results show an overall low variation between ChemGrp 1 and 3, which differ one another based on higher or lower concentrations of Na. On the other hand, Ba variations clearly mark the discrimination between the main cluster ChemGrp 2, and the smaller cluster made up

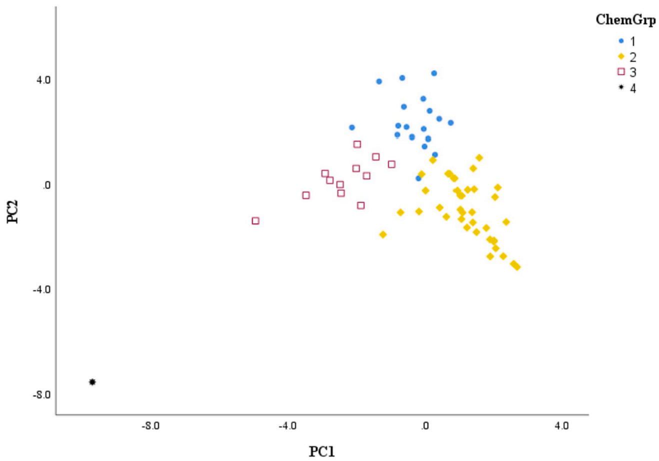

Fig. 10. Scatter plot displaying the ceramic samples from the dataset according to PC1/PC2. Different colors and shapes refer to the compositional grouping (ChemGrp#) suggested earlier by the hierarchical cluster analysis.

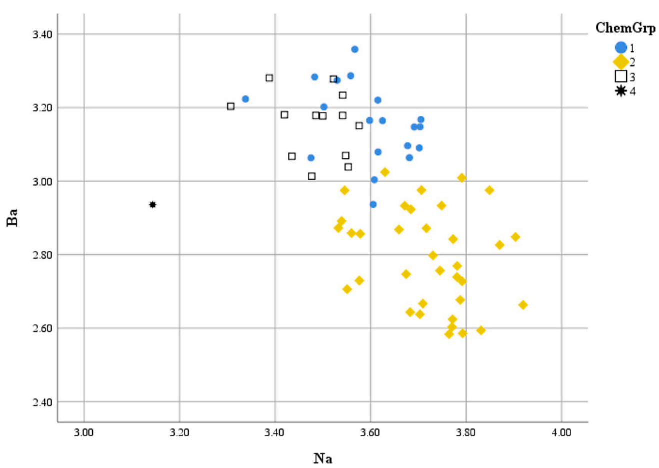

Fig. 11. Ceramic samples arranged according to the weight of Na/Ba ratios (%).

by ChemGrp1 and ChemGrp3.

The results point directly to the local geology, which is homogeneously characterized by evaporites and carbonate rock formations, alongside Fe-rich clay deposits (Basilone, 2018). The main source of carbonate rocks and inclusions comes from reef limestone, marls, and marly clay deposits where carbonate rocks and sandstone contain small amounts of Ba that occurs mostly in K-feldspar and micaceous deposits alongside Fe, and Na. Barium is often found in deposits associated with K-rich minerals that are decomposed through chemical weathering. Sodium is a widespread component within the local geology in the form of sodium chloride (rock salt) and sodium sulphate. Therefore, the presence of higher or lower concentrations of Ba-rich and Na-rich feldspars can be linked with the constant weathering of carbonate rock deposits across the Upper Platani valley.

4.3. The data and the context

The occurrence of normally distributed values suggests an overall compositional homogeneity of the raw materials used to make the pots. All the compositional groups recorded include many different ceramic typologies, with no real preference or direct link between compositional fingerprint and products. At the sanctuary, cups are very abundant both through space and time, and their distribution highlights the occurrence of a very standardized conception of local pottery tradition.

ChemGrp 1 mostly includes the *askos*, the pedestal basins and bowls, and few cooking ware types, along with the pedestal *pyxis*. ChemGrp 2 and 3, on the other hand, are dominated by a very repetitive repertoire of pedestal cups. The former surprisingly includes pottery of both local and non-local tradition, thus suggesting that standardized local manufacturing techniques were used indiscriminately for the ceramics at the sanctuary. The pedestal basin (Fig. 12A) from Hut 2 (39050) that is believed to be a Malta type, the clay pedestal (39067) of Lipari or peninsular origins (Fig. 12B), the type of cup commonly associated with indigenous contexts of coastal Sicily (39089), and a jug (39092, see Fig. 8A) from Bothros 2 (Tanasi, 2012) are by definition non-local, but their role as *exotic* goods does not find a relevant match with their chemical composition.

ChemGrp 3 also displays a similar pattern, including very recent ceramic types (39094, Fig. 12D), along with some of the oldest ones (39079, Fig. 12C) that not necessarily belong to the local ceramic tradition. The distinctive chemical variation between 39,092 (ChemGrp 2) and 39,094 (ChemGrp 3), although they belong to the same archaeological context (Bothros 2), represents a surprising discovery. Both artifacts seem to anticipate the later Phoenician-style jugs (8th century BCE and on), and they were intentionally broken and buried together, according to a very common practice recorded among many Mediterranean contexts (Iacono, 2015).

4.4. Polizzello Mountain and Sicily

Prior to interpreting the compositional results we must acknowledge the lack of further geochemical and petrographic data to support this quantitative approach. As highlighted earlier, we integrated the known qualitative information of the Upper Platani valley available with the elemental concentrations from ceramics in order to highlight the potential presence of local and non-local products. However, to deeper investigate the manufacturing processes and the pottery production techniques of ancient communities, the complementary use of other techniques, such as petrography, is recommended.

The relatively low degree of regional variation recorded at Polizzello Mountain also characterizes other Sicilian contexts. Such a trend has been detected since the EBA of Eastern Sicily, where the geography is the primary indicator of discrimination between pottery types (Copat, 2020), although local communities were very aware of the resources available across the landscape (Mentesana, 2018). Overall, the data

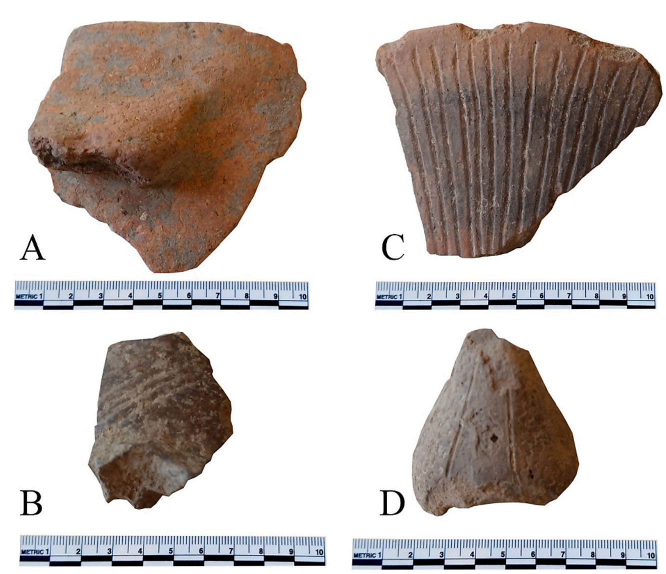

Fig. 12. A) Sample 39,050 (pedestal basin) from ChemGrp 1; B) Sample 39,067 (clay pedestal) from ChemGrp 1. C) Sample 39,079 (pedestal basin) from ChemGrp 2; D) Sample 39,094 (jug) from ChemGrp 2.

from EBA and also MBA suggest the occurrence of local productions paired with homogeneous and standardized sets of techniques and decorative patterns (Rodrıguez et al., 2015, Tanasi et al., 2019).

Such a trend is also visible later on between the LBA and the EIA in the west, where ceramic manufacture was distributed across specific and spatially defined areas (Kolb and Speakman, 2005), along with a lower degree of exchange network for products of non-local tradition. Additional future works including raw material sourcing will definitely improve the accuracy of such assumptions (Kolb and Speakman, 2005), which can be considered still valid for the archaic period, when early Greek colonies still relied on local raw materials and on the indigenous pottery manufacture (Barone et al., 2014; 2005).

The archaeological data point at the persistence of physical and chemical traits within the local pottery throughout the centuries. The persistence of some pottery attributes over others seem to correspond to the adoption of a well-defined set of techno-characteristics that slightly vary across a large geographic scale. Hence, the communities of the Upper Platani valley adopted a very flexible and dynamic manufacturing strategy that relied most likely on local raw materials from very similar sources, potentially within a geologically homogeneous setting, which enabled them to keep the recipes standardized, with a very low degree of variation.

5. Conclusion

The lack of a proper, or standardized, relationship between composition and typology generates a highly dynamic dataset where pots do not follow a unique manufacturing profile. As a consequence, it is not possible to infer any spatial relations between pottery composition and types. Additionally, the lack of information about specific social dynamics of prehistoric societies of Sicily, including the definition of pottery manufacture, does not allow any further comparison between- and within-site across the Platani Valley. The archaeological pottery at the sanctuary reflects the need of both the potters and the customers to conform to specific activities. While the political setting of the island had been gradually changing between the LBA and the EIA, the archaeological record did not show any meaningful shift or change in the ceramic assemblages at the sanctuary. The INAA analysis did not just provide a strong support for the original interpretation of the sanctuary, but also emphasizes the strong attachment of the indigenous prehistoric groups towards their pottery tradition. Therefore, information regarding the chemical fingerprints of pottery shed a light upon some crucial aspects of raw material sourcing, including the possibility that the potters used to gather sources locally, across a very distinctive, but yet large, geographic area.

CRediT authorship contribution statement

Gianpiero Caso: Conceptualization, Formal analysis, Funding acquisition, Resources, Writing – original draft. **Davide Tanasi:** Conceptualization, Investigation, Resources. **Michael D. Glascock:** Data curation, Formal analysis, Validation. **Robert H. Tykot:** Supervision, Validation.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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