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PROVENANCE DETERMINATION BY NEUTRON ACTIVATION ANALYSIS OF SELECTIVE POTTERY IN THE SPERCHEIOS VALLEY (FTHIOTIDA, CENTRAL GREECE)

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ABSTRACT

In this short note, a provenance determination of 15 selected pottery sherds from the prehistoric settlement (Doka's plot) at Frantzi is presented using for the Neutron Activation Analysis method the Research Reactor at Delft, Netherlands. The large databank of elemental concentration patterns at Bonn was helpful to locate the origin of 2/3 of the vessels and to underline the extensive trade network with the palatial centers of the central Greece and Peloponnese during the Mycenaean period. For some of these commercial activities the Phocis trade route was used, which connects the valley of the Spercheios with the Krisean Gulf in Phocis. It is also confirmed that the local ceramic production of the settlements in the Spercheios valley was considerable, as confirmed by the exported products.

KEYWORDS: Late Helladic, Bronze Age, pottery provenance, Neutron Activation Analysis, trade network

1. INTRODUCTION

Within the cultural and geomorphologic unity of the Spercheios Valley in Fthiotida in central Greece, the remains of a prehistoric settlement were uncovered at the village of Frantzi in the SE of the valley, south of the Spercheios river, c. 5 km south of the modern town of Lamia (Fig.1). The rescue excavations (2005-2007) show that the hill, named by the villagers 'Kotronakia' (meaning 'little stones'), was inhabited from the beginning of the MH period until the end of the Mycenaean palatial period (LHIIIB2-IIIC-early). The Mycenaean complex at Frantzi was built on the

architectural remains and debris of the LHIIIB/IIIA1 and MHIII/LHI periods. It was in use from LHIIIA2-late/LHIIIB, and remained active into LHIIIB2/LHIIIC-early. The main house includes two rooms, entirely investigated, and part of a third, the northern one, partly investigated (Fig.2). The complex was built according to the vertical N axis and the horizontal E axis of the two corridors on the E side of the house and resembles the normal Mycenaean complex consisting of rectangular 'megaroid' house with two or three rooms, corridors and secondary rooms arranged on two axes (Karantzali 2012, 2013, 2021).



Figure 1. Map of the Spercheios valley with the prehistoric sites of Frantzi, Lygaria, and Lamia

In order to determine the local ceramic production from the imported vessels and, if possible, to trace the origin of the imports to the Frantzi settlement, several samples were selected and the most of them analysed at Demokritos by Anno Hein and Vasilis Kilikoglou. (Karantzali, Hein, Kilikoglou forthcoming). For this purpose, the Middle Helladic III - Late Helladic I and Late Helladic II - III pottery from the settlement of Frantzi was divided into eight macroscopic fabrics or categories, based on the color, the technical features of the clay (quality, quantity of inclusions, mica, hardness, etc.) and on the surface treatment (wash, dilute

or stable thick slip, quality of paint, etc.). The first results, still unpublished, show that most of the samples present similarities in both fabric and elemental composition, indicating that a large part of the Late Helladic pottery from Frantzi prehistoric settlement was made from basically the same type of clay or from geochemically related sources. It is also confirmed that high-quality pottery is also produced in the Mycenaean settlement at Frantzi, while imported vases were few.

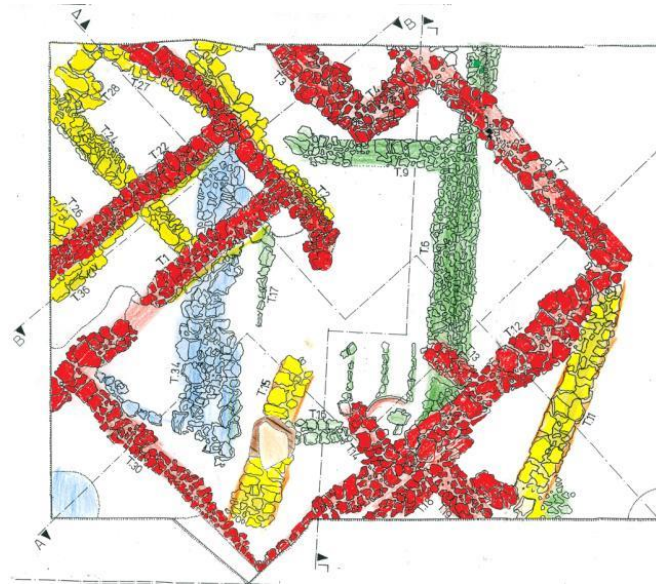


Figure 2. Architectural plan of the prehistoric remains at Frantzi settlement. Red: LHIIIB2/LHIIIC-early. Yellow: LHIIIB-III A1-LHIIIA2-early Green: MHIII-LHI.

2. SAMPLES AND METHOD

For the present project, mainly samples of questionable origin have been selected. Fifteen (15) samples were therefore selected for analysis from pottery

pieces that are macroscopically considered to be either imported or of high quality locally produced and also from ceramics whose fabric was very different from the local ones.

Table 1. Average concentrations of 30 elements of group X207 in µg/g (ppm), if not indicated otherwise, and the standard deviation (root mean square deviation) σ in %. All 21 members of the group present in the Bonn databank are considered.

As	σ	Ba	σ	Br	σ	Ca%	σ	Ce	σ
5.15	1.45	450.	55.4	1.30	0.82	2.12	0.30	76.2	1.45
Co		Cr		Cs		Eu		Fe%	
34.5	2.73	249.	18.2	8.25	0.22	1.28	0.056	6.44	0.13
Ga		Hf		K%		La		Lu	
29.6	4.11	4.62	0.20	2.94	0.077	35.0	1.01	0.52	0.025
Na%		Nd		Ni		Rb		Sb	
0.92	0.11	30.4	3.58	243.	39.3	164.	4.69	0.66	0.083
Sc		Sm		Ta		Tb		Th	
26.8	0.48	5.59	0.33	1.04	0.034	0.78	0.051	13.7	0.34
U		W		Yb		Zn		Zr	
.71	0.094	2.43	0.26	3.26	0.086	136.	11.3	177.	27.6

To determine the origin of the vessels, Neutron Activation Analysis (NAA) was applied. It is a method very well suited for provenancing of pottery. It is in use since the 60ties of the last century (Perlman and Asaro 1969; Harbottle 1976) and well accepted today (Mommsen and Japp 2014; Demakopoulou et al. 2017, 8). The elemental concentration in a pottery vessel corresponds to the one of the clay paste prepared by the ancient potters, and that in turn points to the clay bed(s) exploited and thought to be situated in the contiguity of the workshop. Therefore, all products made of this paste have the same elemental concentration pattern and all pieces made there can be recognized. If by measuring so-called local reference material like e.g. kiln wasters the pattern(s) of different workshops can be obtained and all products made there can be

traced back to its origin. NAA is able to measure up to about 30 elements, so the probability to find the same elemental pattern at different sites is small. The pottery composition can be assumed to be unique and this is the reason this chemical method of provenance is called also chemical fingerprinting. In Bonn the NAA method is applied routinely since more than 30 years and has been described already in detail (Mommsen et al. 1991; Mommsen 2011; Demakopoulou et al. 2017). Samples of about 80 mg, obtained by drilling with a corundum drill bit, were irradiated with a flux of $5 \cdot 10^{12}$ neutrons/(cm² s) at the research reactor of the Reactor Institute in Delft. Absolute concentration data for about 30 elements, shown in Tables 1 and 2, were calculated by using the Bonn pottery standard calibrated with the Berkeley standard

(Perlman and Asaro 1969; Mommsen and Sjöberg 2007). To find samples of the same composition and hence of the same origin the statistical filter method developed in Bonn was used (Beier and Mommsen 1994). Compared to Principal Component Analysis (PCA) or the different cluster analyses (CA) calculating dendrograms, it has the advantage that experimental uncertainties and also possible constant shifts of the concentration data due to dilutions or elutriations of the clay paste during the clay paste preparation procedure can be considered (Mommsen and Sjöberg 2007).

3. RESULTS

According to the NAA data only three sherds (No 4, 8, 9) are probably local products having the pattern X207 (Table 1) (Fig. 3):

- Fran 4: 117/2 from room C of Mycenaean complex. Base sherd of a krater FS 9. Macroscopic fabric 2, clay reddish-yellowish, gray in core, soft, surface worn out, monochrome dark, reddish brown. LHIIIB-IIIC-early context.
- Fran 8: 87-92-87/5 from destruction layer of early Mycenaean phase - room C of Mycenaean complex. Body shreds from a large closed vase. Macroscopic fabric 2. Clay reddish/orange-yellowish, gray in core, semi-fine, slip reddish/orange-yellowish lustrous and groups of reddish horizontal bands. Date: LHIIIA2-early (?).
- Fran 9: 265/1 accumulated deposit under the early Mycenaean phase. Body sherd from a large closed jar. Macroscopic fabric 2, clay hard reddish, gray in core, slip same, burnished, and red painted spiral out. MHIII-LHI context.



Figure 3. Fran 4, 8 and 9: NAA group X207

This assumption is supported by the fact that this composition is found in 13 from 20 samples taken

¹ Valogourna and Frantzi are nearby areas of the eastern region of the Spercheios valley. However, Valogourna is the area of the valley that is closer to Spercheios River than Frantzi. A Hellenistic pottery kiln was found in the outskirts of

from sherds of the 1993 excavation of Valogourna/Lamia.¹ Further members of this group are one sample from Locris/East Fthiotida, and one from Livanates/East Fthiotida, both in the neighbourhood and two samples from Bikiorema (in the NE part of Spercheios valley). Because of this distribution of the members of pattern X207, it has a high probability to describe the local Spercheios valley ware. It is also possible that a local workshop or group of workshops of the valley were utilizing raw materials from the main alluvial deposits related to the Spercheios River.

Three further pieces are chemical singletons (Fig. 4). Nothing can be concluded from such singletons, they represent still unknown workshops or they might have been contaminated in modern or in ancient times.

- Fran 10: 121/17, from Room C of Mycenaean complex. Neck of a small piriform jar FS45. Macroscopic fabric 4, clay of limestone texture, buff-whitish, dark brown painted bands. Two fine bands on the rim and a broad band on the neck. Two bands inside the neck. Date LH IIIB2.
- Fran 15: 248a, from the deposit under the early Mycenaean phase. Kantharos rim and handle. Clay semi-fine, reddish-brown, limestone, porous with silver mica and black sand inclusions. Exterior painted monochrome black with white decoration of three horizontal bands and part of a circle on the body, one row of white solid circles on the external black surface of the handle. Rim inside monochrome black with white row of linked lozenges. MHIII-LHI context.
- Fran 12: 145/12. Mixed accumulated deposit under room B. Body sherd of a small closed vase. Macroscopic fabric 4. Clay buff-greenish light, fine, surface very well burnished. Black horizontal bands outside. LHIIIA1-LHIIIA2-early (?) context.



Figure 4. Fran 10 and 15: singles.

The remaining nine (9) pieces are imports, having patterns that were assigned with a high probability to specific sites or regions.

Valogourna, suggesting that the region was suitable for the establishment of pottery workshops. Karantzali 2001-2004, 369-370.

The NAA established imports to the Frantzi settlement from Aitolokarnania (pattern AkaR/ 2 samples/ Fig. 5), which is a group that holds many samples from Loutrakis-Katounas, but no reference piece (Jung et al. 2015). However, sample No 6 has a non-vanishing probability to come instead from Aitolokarnania from the Northern Aegean (X026), (Mommsen and Gimatzidis, forthcoming; Riehle et al. forthcoming).

- Fran 1: 253e/1, from destruction layer outside the Mycenaean complex. Large parts from a closed vase (hydria or piriform jar). Macroscopic

fabric 2, clay reddish -yellowish, fine soft, surface reddish-yellowish, lustrous, horizontal broad bands outside of dark reddish-brown to black paint. LHIIIB-IIIC-early context.

- Fran 6: 119/4, from destruction layer of early Mycenaean phase, room C of Mycenaean complex. Macroscopic fabric 6 (imported or high local quality). Body sherd of large closed vase, clay dark brown-gray semi fine, slip gray, lustrous (very well burnished) and broad black bands out. LHII-III A context.



Figure 5. Fran 1 and 6: NAA group AkaR.

The NAA has also shown imports from Boeotia (Fig. 6), possibly Thebes (Schwedt et al. 2006 (B = pattern TheB); Mommsen 2009, 87(Theb); Andrikou et al. forthcoming), which are as follows.

- Fran 2: 136, from the destruction layer, Room C of the Mycenaean complex. False-neck, flat base and part of the handle from a storage/transport stirrup, clay buff yellowish, with mica, limestone inclusions and black sand. Surface washed buff-yellowish. Dark reddish-black band round the base and round the false-neck. LHIIIB-IIIC-early context.
- Fran 5: 119/5 from the destruction layer of the early Mycenaean phase - room C of Mycenaean complex. Body sherd of a closed vase (large alabastron). Macroscopic fabric 6 (imported or high

local quality). Clay reddish-yellowish, fine, surface slightly burnished, 2 bands out (one fine, one broad), of dark reddish-brown paint. LHII-III A context.

- Fran 7: 87/9 from the destruction layer of the early Mycenaean phase, outside the Mycenaean complex. Body sherds from a monochrome kylix. Macroscopic fabric 6 (imported or high quality local). Clay reddish-yellow, fine, well-baked, black lustrous paint in and out. Date: LHIIIA1.
- Fran 11: 145/5. Mixed accumulated deposit under room B. Body sherd from a krater or large basin. Macroscopic fabric 8 (imported). Clay brown-greyish, surface same, very well burnished in and out. Dark brown to black paint. Band and vertical zigzag (FM61) decoration. LHIIIA1-III A2-early context.



Figure 6. Fran 2, 7, 11, and 5: NAA group TheB

One sample belongs to the NAA group ChiA (Huy et al. 2020), archaeologically assigned to Chios or a workshop at the coast opposite Chios:

- Fran 3: 203/9 from destruction layer, north corridor of Mycenaean complex. Body sherd from a domestic storage/transport jar. Clay reddish-buff, gritty, limestone inclusions, golden mica and black sand, surface washed yellowish out. LHIIIB2-IIIC-early context (Fig. 7).

In addition, the NAA established imports to the Frantzi settlement from the north-eastern Peloponnese (1 sample, MYCE, LHIIIB-III A1), probably an early subgroup of MYBE (Mommsen et al. 1988, Lis et al. forthcoming), and from Achaia/Elis (OlyA, Mommsen et al. 2015), which are as follows.

Group MYCE: Fran. 14: 162/1. Destruction layer of the early Mycenaean phase. Large rounded alabastron FS83, mended by many fragments. Macroscopic

fabric 6 (imported or high local quality). Clay buff-yellowish, fine, slip buff-yellowish with traces of burning and reddish-brown decoration. Four broad bands, rock-pattern (FM32), triple curved lines round the handles. Date: LHIIIB-III A1 (Fig. 7).

Group OlyA: Fran.13:159/1. Room B – under the last floor of Mycenaean complex. Deep bowl FS284. Macroscopic fabric 2, clay reddish-yellow, slip yellowish/whitish, dark brown black painted decoration. Three splashes on the handle, one band round the rim, two bands on the body, a standing row of stemmed spiral (FM 51:5), and monochrome inside. Date: LHIIIB1 (Fig. 7).

In Fig. 8 we present the result of a discriminant analysis of the 6 groups with members of the samples from Frantzi. All these groups are well separated.

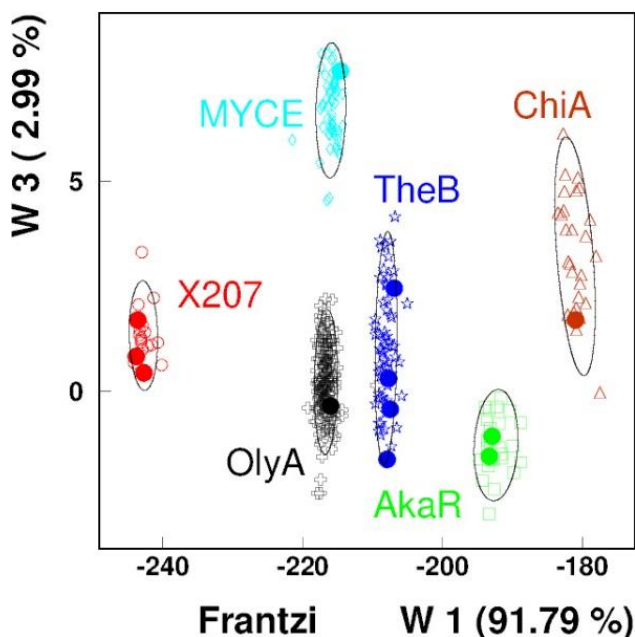


Figure 8. Result of a discriminant analysis (DA) of the groups with members of Frantzi settlement, data corrected for dilution, assuming 6 clusters using all elements given in Tab. 1 except As, Ba, Br, and Na. Plotted are the discriminant functions W1 and W3, which cover 91.8 % and 3.0 % of the between-group variance. The ellipses drawn are the 2 σ boundaries of the groups. Samples from Frantzi are shown as filled circles. The different groups (AkaR: Aitolocarnania, ChiA: Chios, MYCE: north-eastern Peloponnese, OlyA: Achaia/Elis, TheB: Thebes, and X207: probably local region of Frantzi) are well separated. Most of the other members of the groups, if published, are mentioned in the given references in the text.



Figure 7. Fran 3: NAA group ChiA; Fran 14: NAA group MYCE, Fran 13: NAA group OlyA

The raw concentration data shown in Table 2 and can be downloaded from the website Momm-sen.hiskp.uni-bonn.de.

Table 2. Raw concentration data is shown of the 15 samples from the Frantzi/Dokas Plot in mg/kg (ppm), if not indicated otherwise, and the experimental uncertainties

Sample	As	Ba	Br	Ca%	Ce					
Fran 1	3.17	0.12	408.	44.0	1.47	0.23	1.62	0.24	70.2	0.43
Fran 2	4.68	0.10	578.	36.0	2.09	0.22	4.28	0.20	46.6	0.36
Fran 3	4.80	0.12	396.	38.7	2.23	0.24	6.36	0.22	52.7	0.40
Fran 4	6.23	0.13	446.	40.6	2.18	0.25	2.00	0.22	79.6	0.45
Fran 5	6.77	0.12	410.	37.7	3.18	0.28	4.25	0.21	62.0	0.42
Fran 6	5.15	0.13	324.	40.6	1.97	0.25	2.60	0.23	68.9	0.43
Fran 7	5.52	0.13	416.	37.2	1.70	0.22	3.28	0.20	67.3	0.44
Fran 8	3.72	0.13	418.	39.0	0.42	0.21	1.78	0.21	78.1	0.45
Fran 9	4.10	0.14	375.	38.7	0.87	0.21	2.22	0.21	76.0	0.45
Fran 10	4.56	0.10	577.	30.2	3.71	0.29	12.8	0.19	58.5	0.40
Fran 11	1.79	0.13	423.	36.4	5.13	0.39	4.27	0.20	58.8	0.41
Fran 12	2.90	0.13	247.	34.3	1.28	0.22	12.7	0.22	47.4	0.39
Fran 13	2.36	0.14	501.	39.0	0.74	0.22	1.64	0.20	77.8	0.45
Fran 14	6.09	0.13	455.	32.1	1.70	0.21	9.07	0.20	66.6	0.42
Fran 15	3.12	0.14	337.	34.2	0.85	0.22	3.38	0.19	54.2	0.41
Sample	Co	Cr	Cs	Eu	Fe%					
Fran 1	34.4	0.15	312.	1.14	6.94	0.13	1.26	0.023	6.22	0.018
Fran 2	28.2	0.14	341.	1.17	3.46	0.097	0.87	0.019	4.25	0.014
Fran 3	36.5	0.16	482.	1.51	7.37	0.12	1.09	0.022	6.21	0.018
Fran 4	34.8	0.16	256.	1.05	8.57	0.14	1.36	0.025	6.89	0.020
Fran 5	41.0	0.17	406.	1.36	6.23	0.12	1.14	0.023	6.52	0.019
Fran 6	34.7	0.16	311.	1.14	6.31	0.12	1.29	0.023	6.27	0.018
Fran 7	38.8	0.17	351.	1.25	8.07	0.13	1.21	0.024	6.84	0.020
Fran 8	34.9	0.16	248.	1.04	9.06	0.14	1.37	0.025	6.91	0.020
Fran 9	36.3	0.16	258.	1.05	7.81	0.13	1.30	0.024	6.47	0.019
Fran 10	23.1	0.12	237.	0.97	3.46	0.10	1.16	0.022	4.76	0.015
Fran 11	35.0	0.16	304.	1.13	6.21	0.12	1.12	0.022	5.71	0.017
Fran 12	40.8	0.17	428.	1.40	5.18	0.11	0.93	0.020	5.82	0.017
Fran 13	32.8	0.15	229.	0.99	8.10	0.13	1.39	0.024	6.29	0.018
Fran 14	28.4	0.14	212.	0.94	11.8	0.14	1.18	0.022	5.54	0.017
Fran 15	39.4	0.17	324.	1.19	17.2	0.16	1.04	0.021	6.22	0.018
Sample	Ga	Hf	K%	La	Lu					
Fran 1	20.5	1.86	4.77	0.064	2.54	0.020	32.5	0.084	0.51	0.012
Fran 2	14.4	1.56	3.50	0.053	1.90	0.017	21.6	0.065	0.33	0.010
Fran 3	18.2	1.84	3.71	0.060	1.91	0.018	24.7	0.071	0.41	0.011
Fran 4	22.9	1.98	4.89	0.068	3.13	0.023	37.3	0.091	0.53	0.013
Fran 5	20.7	1.93	4.10	0.064	2.32	0.020	28.6	0.078	0.45	0.012
Fran 6	24.0	2.21	4.93	0.065	2.61	0.023	32.7	0.086	0.50	0.012
Fran 7	25.1	2.12	3.94	0.066	2.85	0.023	31.7	0.083	0.49	0.013
Fran 8	27.2	2.29	4.64	0.068	3.10	0.026	36.8	0.093	0.54	0.013
Fran 9	24.5	2.37	4.75	0.066	2.88	0.026	34.7	0.089	0.49	0.013
Fran 10	16.5	1.81	4.14	0.059	1.50	0.018	26.2	0.074	0.41	0.012
Fran 11	22.2	2.47	4.14	0.062	2.63	0.026	27.8	0.083	0.44	0.012
Fran 12	20.1	2.55	3.10	0.058	0.45	0.020	21.7	0.071	0.36	0.012
Fran 13	25.8	2.79	4.94	0.067	2.94	0.030	36.1	0.096	0.53	0.014

Fran 14	27.0	2.47	3.54	0.061	2.76	0.027	32.6	0.088	0.43	0.013
Fran 15	21.5	2.89	3.70	0.063	2.28	0.029	24.9	0.080	0.42	0.013
Sample	Na%		Nd		Ni		Rb		Sb	
Fran 1	1.04	0.004	30.9	1.31	277.	34.7	146.	2.84	0.46	0.037
Fran 2	0.71	0.003	17.3	1.06	454.	32.2	84.8	2.17	0.48	0.030
Fran 3	0.91	0.004	23.3	1.23	488.	37.3	103.	2.55	0.52	0.034
Fran 4	0.88	0.004	32.9	1.36	224.	38.0	171.	3.13	0.66	0.036
Fran 5	0.78	0.004	23.6	1.25	481.	39.5	126.	2.85	0.50	0.033
Fran 6	1.07	0.005	31.3	1.33	356.	36.2	136.	2.80	0.49	0.035
Fran 7	0.77	0.004	30.1	1.31	398.	38.3	153.	3.07	0.51	0.033
Fran 8	0.93	0.004	34.9	1.36	200.	36.1	177.	3.18	0.55	0.035
Fran 9	0.93	0.005	28.5	1.31	241.	35.9	156.	3.00	0.56	0.036
Fran 10	0.32	0.002	22.8	1.14	236.	31.0	88.5	2.33	0.38	0.026
Fran 11	0.93	0.005	24.2	1.22	252.	34.8	140.	2.86	0.51	0.033
Fran 12	1.05	0.005	20.0	1.18	654.	39.9	42.6	2.25	0.48	0.033
Fran 13	1.07	0.005	33.3	1.33	175.	34.3	164.	3.07	0.57	0.036
Fran 14	0.60	0.004	26.6	1.23	237.	33.4	167.	3.00	0.52	0.031
Fran 15	1.00	0.005	20.2	1.18	366.	35.9	130.	2.84	0.32	0.033
Sample	Sc		Sm		Ta		Tb		Th	
Fran 1	25.2	0.026	5.98	0.017	1.04	0.050	0.80	0.066	12.4	0.075
Fran 2	15.6	0.020	3.37	0.013	0.58	0.042	0.45	0.054	8.12	0.062
Fran 3	22.7	0.025	4.59	0.016	0.78	0.047	0.70	0.065	9.26	0.069
Fran 4	29.1	0.028	6.16	0.018	1.12	0.052	0.83	0.071	14.5	0.081
Fran 5	26.7	0.027	4.97	0.017	0.97	0.050	0.73	0.067	11.1	0.074
Fran 6	24.9	0.026	5.62	0.018	1.01	0.049	0.84	0.066	12.5	0.075
Fran 7	28.7	0.028	5.35	0.018	0.97	0.051	0.69	0.070	12.5	0.078
Fran 8	29.3	0.028	6.03	0.019	1.01	0.051	0.81	0.071	14.5	0.082
Fran 9	27.1	0.027	5.92	0.019	1.04	0.051	0.87	0.070	13.1	0.079
Fran 10	19.4	0.023	4.57	0.017	0.89	0.045	0.75	0.060	9.60	0.067
Fran 11	23.2	0.025	4.52	0.017	0.86	0.048	0.68	0.063	11.9	0.074
Fran 12	22.6	0.024	3.79	0.016	0.65	0.046	0.58	0.062	8.79	0.068
Fran 13	26.0	0.027	6.07	0.020	1.12	0.051	0.85	0.068	13.6	0.080
Fran 14	23.3	0.025	4.92	0.018	0.88	0.047	0.54	0.064	12.1	0.074
Fran 15	24.1	0.025	3.98	0.017	0.80	0.049	0.57	0.064	9.74	0.072
Sample	U		W		Yb		Zn		Zr	
Fran 1	2.71	0.24	1.92	0.17	3.17	0.071	118.	2.35	145.	26.2
Fran 2	1.60	0.20	1.80	0.14	1.96	0.055	72.4	1.89	112.	21.5
Fran 3	1.82	0.22	1.82	0.17	2.66	0.064	97.9	2.22	100.	25.4
Fran 4	2.78	0.24	2.61	0.19	3.52	0.068	151.	2.61	177.	28.2
Fran 5	2.00	0.22	2.31	0.17	2.77	0.063	119.	2.41	148.	27.3
Fran 6	2.02	0.24	2.14	0.19	3.23	0.068	133.	2.42	182.	26.3
Fran 7	2.18	0.22	2.20	0.18	3.13	0.063	132.	2.50	99.5	27.8
Fran 8	2.93	0.24	2.39	0.19	3.35	0.066	143.	2.55	166.	28.2
Fran 9	2.90	0.23	2.49	0.20	3.27	0.065	130.	2.45	170.	27.3
Fran 10	1.83	0.17	1.91	0.15	2.83	0.051	77.2	1.97	175.	25.5
Fran 11	2.48	0.23	2.04	0.19	2.74	0.061	139.	2.45	203.	26.2
Fran 12	1.62	0.22	1.91	0.20	2.19	0.059	89.7	2.16	160.	25.3
Fran 13	2.18	0.24	3.33	0.22	3.45	0.066	132.	2.44	228.	27.0
Fran 14	2.39	0.20	2.28	0.19	2.78	0.056	107.	2.21	160.	25.3
Fran 15	1.93	0.22	2.21	0.21	2.60	0.061	111.	2.30	164.	26.4

4. DISCUSSION AND CONCLUSIONS

Given the only small number of 15 samples it still can be noted that the prehistoric settlement of Frantzi imported pottery vessels in a far-ranging trade network extending from the closer neighbourhood (Aitolokarnania, Boeotia) to as far as the north-eastern (Argolid) and the north-western (Achaia/Elis) Peloponnese, and Chios. Also exports of vessels with the probably local pattern X207 are known to Achaia (1) and to as far as Histria (1).

The occurrence of such trade networks in this period is expected. There was a circulation of objects

and ideas through a route of fine utensils of a domestic specialized function. The site of Frantzi, located in the SE part of the Spercheios valley, is on the land route from Phocis to Thessaly. The so-called isthmus trade route (with several passages), that connected the Krisean Gulf (present-day Itea Gulf) and the Malian Gulf, was a communication corridor in Mycenaean times between the two regions (Käse 1973, 74-77). Therefore, commodities, stored in vase containers, which reached Frantzi and generally the settlements in the Spercheios valley from the NE and NW Peloponnese (Argolid) and Western Greece (Achaia, Aitolokarnania), and as well as, from Frantzi to Achaia, probably travelled by this trade route, which

related major areas of the Mycenaean world, such as the valley of Spercheios and Kephisos to Phocis and Boeotia (Fig. 9). Phocis was a thriving region until the end of the Mycenaean period, which is also confirmed by recent excavations and studies (Sideris et al. 2017, 271-285; Liritzis et al. 2020, 1-81; Liritzis et al. 2023, 1-28).

Moreover, the LH III settlements in the Spercheios valley, were quite prosperous, as evidenced by the

finds of luxury items in the Mycenaean tombs of the valley (see: Karatzali 2021 with the relevant bibliography). The results of the NAA analysis demonstrate the communication of the Frantzi settlement with the Mycenaean palatial centres of Boeotia and the Argolid, as well as with distant ports ("Emporia") of the NE Aegean islands, probably through the strong palatial network.

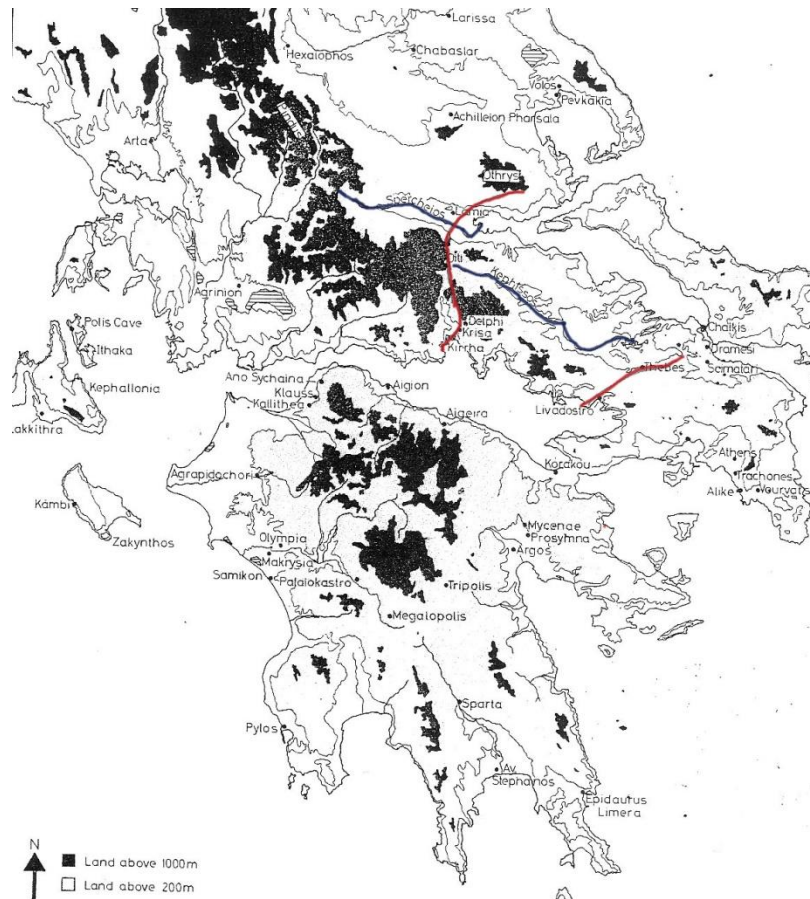


Figure 9. Map of central and southern mainland Greece with marked trade routes and the valleys of Spercheios and Kephisos.

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